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TECHNICAL BIBLE FOR NEW DETCOS.(U)
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TECHNICAL BIBLE FOR NEW DETCOS

Frank J. Carvell, Maj, USAF

May 1981

AIR WEATHER SERVICE (MAC)
Scott AFB, Illinois 62225

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AIR WEATHER SERVICE

TECHNICAL BIBLE for NEW DETCOs

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AUTHOR MAJOR FRANK J. CARVELL, USAF

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TITLE TECHNICAL BIBLE FOR NEW DETCOs.

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Submitted to the faculty in partial fulfillment of requirements for graduation.

AIR COMMAND AND STAFF COLLEGE

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The author recently spent two years supervising intensive efforts to improve the technical health of 48 Air Weather Service (AWS) forecasting units. These efforts revealed that the greatest technical challenge of AWS is to improve the basic skill level of its highly intelligent and motivated--but extremely inexperienced--forecasting team. A major portion of this responsibility falls on the already overworked detachment commanders (detcos). The purpose of this guide is to lighten their burden. If followed, it will: (1) help detcos more quickly and effectively organize their technical forecasting program; and (2) provide them the tools required to lead, teach, and train their forecasting team to reach its full potential.

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PREFACE

This "technical bible" is dedicated to YOU, the detachment commander (detco). Your job is one of the most important in Air Weather Service (AWS)--YOU are the leader of a team of key people who operate daily "where the rubber meets the road." BEST OF LUCK!

As detco, one of your highest priority functions is to provide the technical leadership which insures the best possible forecasting support for your customers. This "bible" was designed to help you accomplish this task more readily and effectively. It is based on information obtained from reliable sources including regulations, pamphlets, manuals, and training materials. Most importantly, however, the logic behind the approach to improving the technical health of your forecasting section is based on years of experience and intensive efforts to analyze the fundamental needs of AWS forecasters. The author has spent 13 years as an AWS weather officer. His jobs included being a detachment forecaster, Staff Weather Officer (SWO) to the President, staff meteorologist, OIC of an AWS operational unit, and an Army division SWO. Finally, his most recent two years, spent as Chief of the Fifth Weather Wing's Scientific Services Branch, revealed the critical need for a Technical Bible for Detcos. The need was identified and contents developed using three primary sources: (1) the author's in-depth analyses of more than 50 technical consultant visits performed during 1978-1980 to identify technical strengths and weaknesses of 48 AWS forecasting units; (2) numerous hours spent "picking the brains" of the author's five extremely well-qualified and experienced technical consultants, who worked full-time assessing operational forecasting unit needs; and (3) solicited and unsolicited inputs from several detcos--both new ones and "old heads" who are currently on the firing line or recently have been. The objective was to consolidate this extensive corporate knowledge and experience into a valuable and usable guide. My genuine desire is that this "bible" serves that purpose. YOU DESERVE NO LESS! (The last page is a sheet for your comments and suggestions. Your input is welcomed.)

CONTINUED

Sincere thanks for superb guidance and valuable assistance goes to: my faculty advisor, the 5th Weather Wing Aerospace Sciences Division which sponsored this effort, HQ Air Weather Service, and every detco and technical services officer with whom I have consulted. Last but not least, deepest appreciation goes to my wife and children for their patience and support.

PROFESSIONAL BACKGROUND

Major Frank J. Carvell

Military Experience:

1978-1980	Chief, Scientific Services Branch HQ 5th Weather Wing Langley AFB VA
1977-1978	Staff Meteorologist U.S. Army Training and Doctrine Command Fort Monroe VA
1976-1977	OIC, OL-C, Det 18, 30th Weather Squadron (Staff Weather Officer, HQ 2nd Infantry Division) Camp Casey, Korea
1974-1976	Staff Meteorologist Aeronautical Systems Division Wright-Patterson AFB OH
1969-1972	Presidential Staff Weather Officer/Forecaster Det 2, 6th Weather Wing Andrews AFB MD

Education:

1972-1973	MS, Meteorology Texas A & M University College Station TX
1968-1969	BA+, Meteorology University of Michigan Ann Arbor Michigan
1962-1966	BA in Education, Math Fairmont State College Fairmont WV

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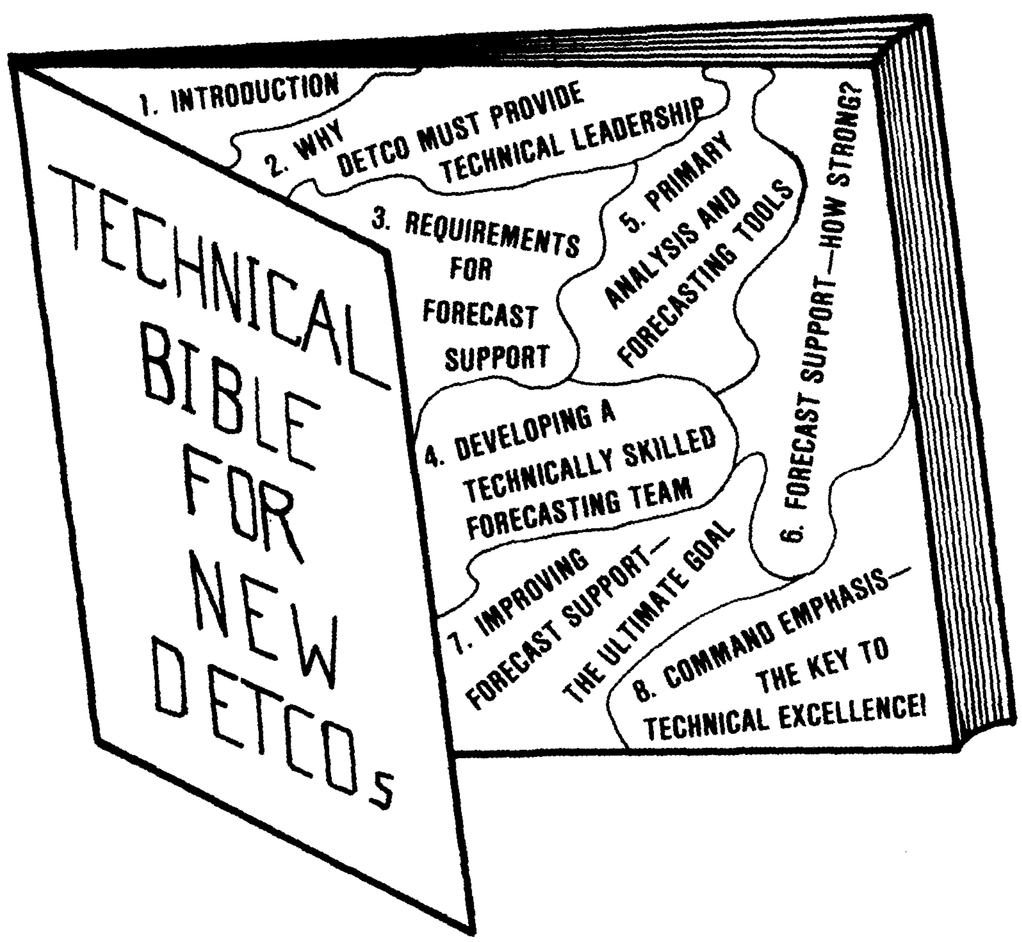


INTRODUCTION

CHAPTER 1

INTRODUCTION

PURPOSE

Congratulations! You should consider it an honor and privilege to have been selected as the detco of an operational unit. But as you know, with privilege comes responsibility--sometimes more than you could ever imagine. Since you are the "keeper of the unit's keys," your responsibility includes <u>everything</u> that goes on at your detachment. A significant chunk of your job falls within the realm of technical leadership of your forecasting team. The purpose of this "bible" is to help you accomplish the technical leadership portion of your task more effectively.

NEED

A wealth of "intelligence" from many experienced AWS people--technical consultants, detcos, etc.--revealed the need for a consolidated technical guide that the detco, with the station chief, could use to organize and supervise the forecasting function. (See the Preface for details.) This "bible" was designed to fulfill that vital need.

USERS/HOW TO USE

· <u>Primary User</u>.

·· <u>You</u>. The target audience of this guide is <u>you</u>, the detco. Some tidbits of the guidance provided may not apply to your unit. Therefore, a good rule might be: "Follow this 'bible' or have a valid reason for not doing so." As a detco, you probably fall into one of three categories.

··· The novice, who has never worked in a weather detachment. You should carefully study this guide, understand it, apply it, and keep it at your fingertips as a ready reference.

··· The detco who has been away from the operational forecasting business for awhile. Although much of the information will not be new, this guide will consolidate all the pieces of the technical puzzle, help you get your technical "kit" together, and serve as a handy reference.

··· The "old head" who is currently working in the weather detachment. Some of the information is geared for a less experienced audience and may appear too basic. However, the majority--and specifically, the approach--will apply.

·· Your station chief. Depending on his experience, you may delegate major portions of the forecasting function to him. But REMEMBER: YOU CANNOT DELEGATE THE RESPONSIBILITY! That's yours <u>alone</u>. Since the station chief is your "right arm," he should also study this guide. You should specify the areas and programs you want him to concentrate on. With you as the catalyst, he can be the implementer.

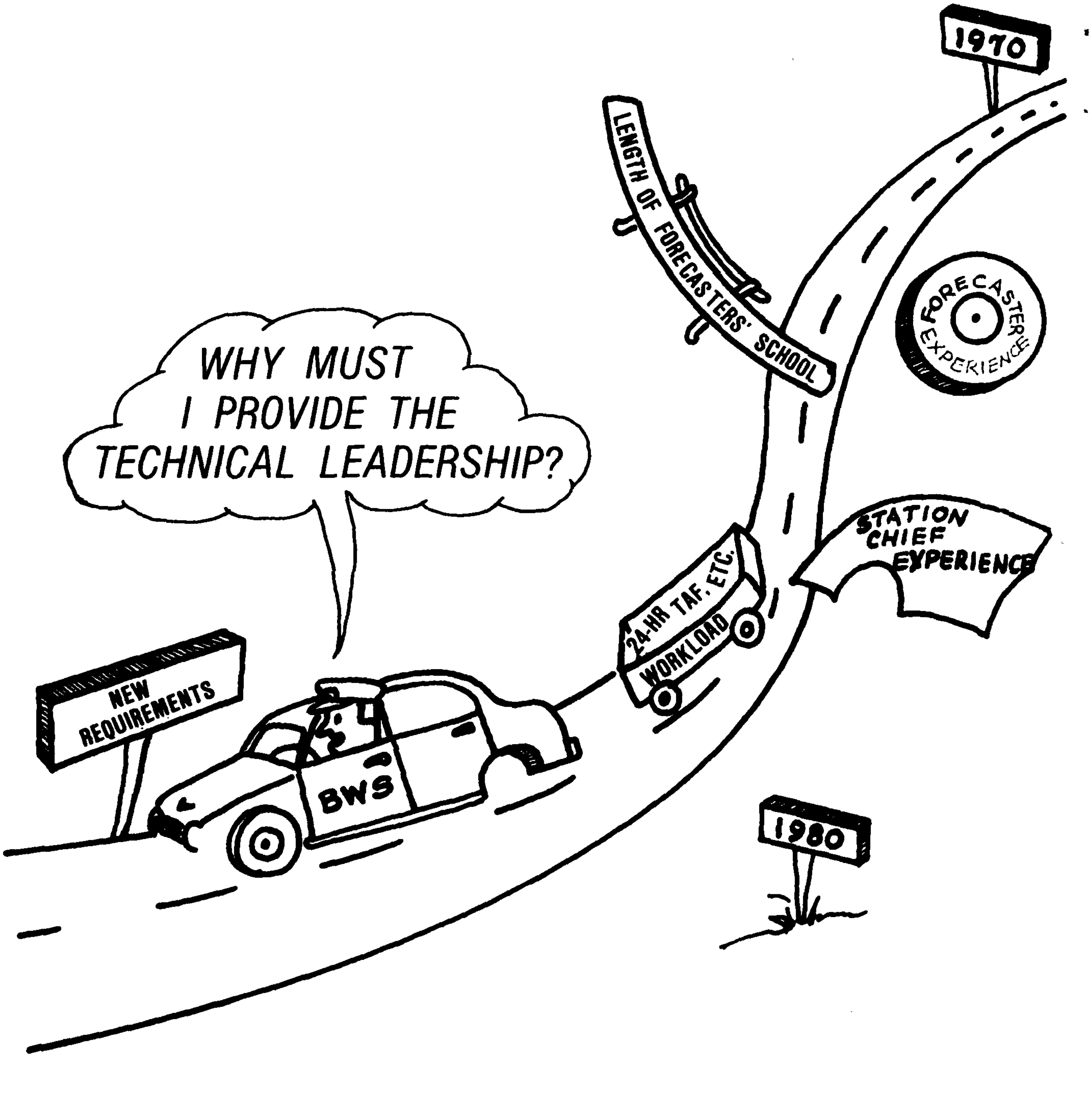
· <u>Secondary Users--Your Duty Forecasters</u>. Although the bulk of this "bible" was written for the unit's supervisors, two sections--Chapter 4, Section 1, "Basic Upper Air Analysis and Forecasting Skills" and Section 2, "Basic Upper Air Analysis Program"--were compiled expressly as teaching tools for your forecasters. Although fundamental, a complete understanding of their contents is a <u>prerequisite</u> to forecasting excellence. Consequently, you <u>must</u> motivate each forecaster to fully comprehend these sections and practice the suggested techniques on a daily basis. The benefits derived will far outweigh the investment made. (The need to understand this material also applies to the unit's teachers--you and your station chief.) You may also want some of your forecasters to review other areas of the guide, e.g., Chapter 5, which describes the primary analysis and forecasting tools available.

CONTENT

Each of the following interrelated chapters address one of seven vital areas concerning the technical aspects of the forecasting function.

- Chapter 2: Why the detco must provide the technical leadership.
- Chapter 3: How to determine and document customer requirements for forecast support.
- Chapter 4: How the detco develops a technically skilled forecasting team (the most important chapter of all).
- Chapter 5: The primary analysis and forecasting tools available to your team.
- Chapter 6: How to determine the "goodness" of your unit's forecast support.
- Chapter 7: How to improve your forecast support.
- Chapter 8: The importance of command emphasis if your unit is going to acquire technical forecasting excellence.

CHAPTER 2



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LENGTH OF FORECASTERS' SCHOOL
FORECASTER EXPERIENCE
WHY MUST I PROVIDE THE TECHNICAL LEADERSHIP?
STATION CHIEF EXPERIENCE
24-HR TAF, ETC.
WORKLOAD
NEW REQUIREMENTS
BWS
1980

CHAPTER 2

WHY MUST THE DETCO PROVIDE THE TECHNICAL LEADERSHIP?

Never in the history of Air Weather Service (AWS) has it been more critical that you, the detco, be the technical leader of your forecasting team. Although always important, several adverse trends in AWS over the past decade have caused your technical leadership role to become even more essential. General Kaehn (AWS/CC) identified his concerns in the 20 Apr 79 letter to his wing commanders:

> ...I know you share my concern over the compressed nature of the enlisted forecaster course at the Chanute Technical Training Center (CTTC). That concern is amplified by the continuing decrease in average experience and expertise *within the enlisted forecaster* force. While I perceive no reverse in this latter trend, I am encouraged by individual wing and unit initiatives to develop and use appropriate training materials to enhance basic meteorological skills. We're getting a follow-on-training program off the ground; we all recognize there's a lot more to be done....

Following are five interrelated adverse trends which emphasize the need for the detco to provide strong technical leadership.

FORECASTER EXPERIENCE

Since the early 1970s, the experience level of AWS enlisted forecasters has decreased drastically. The main cause has been attrition. For example, in 1980, 120 AWS forecasters retired. Many had spent over 20 years in AWS. They were replaced by E-4s and E-5s--fresh out of forecaster's school--with no practical forecasting experience. An additional 120 observers completed the school to replace other forecasters lost to attrition in 1980. In fact, by late 1980, 425--or 34%--of the assigned 1226 enlisted forecasters had one year of experience or less. Unfortunately, this trend of decreasing average experience, estimated to be about 2-1/2 years today--or less than half of what it was in the early 1970s--is expected to continue.

STATION CHIEF EXPERIENCE/WORKLOAD

A decade ago, the forecaster with the most expertise and experience--usually 10-20 years--was selected to be the chief forecaster. He managed the forecasting section. Today, under the "single career ladder" system, the chief forecaster has been replaced by the station chief, who also manages a second section--the observing section. This was previously a separate task delegated to the chief observer. In addition to the "doubled" workload, the NCOs assigned as station chiefs generally have much less forecasting experience than their predecessors, the chief forecasters. Some are recent cross-trainees from outside AWS. Therefore, you may not be able to delegate as much of the technical forecasting aspects to the station chief, who must handle both the forecasting and observing function. Then, who picks up the slack? To some degree, you must--often at the expense of other important but less essential tasks.

LENGTH OF ENLISTED FORECASTERS' SCHOOL

Granted, no formal course is designed to fully qualify a person for his/her job. However, the substantial decrease in the length of the enlisted forecaster's school--from 32 weeks (6-hour classroom days) in 1975 to 18.2 weeks (8-hour classroom days) in February 1979--has adversely effected the practical forecasting knowledge and skills of the graduates. Below are some typical statements made by recent graduates:

> It should be re-emphasized that the course length currently is too short to provide an adequate meteorological basis for excellent forecasting.
>
> Too little time for analysis--time was not available to grasp concepts fully and understand what was being analyzed for.
>
> The course should definitely be lengthened to allow for greater retention of the course material. Myself and numerous other classmates felt as though we had holes drilled in the tops of our heads, a funnel inserted in the hole and data poured into our heads with our fingers inserted into our ears to keep it from coming out.

Consequently, since early 1979, students have had even less opportunity to gain the proficiency they once enjoyed. As a result, OJT becomes even more important--and you must insure your forecasters become and remain fully

qualified. Again, this means you must stay involved in the technical aspects of forecasting.

24-HR VERSUS 6-HR FORECAST RESPONSIBILITY

On 1 March 1979, the length of the detachments' terminal forecast responsibility increased four-fold--from 6 to 24 hours. Before the change, the local forecasters were in the "now-casting" business. They depended on the Air Force Global Weather Central (AFGWC) for the 6-through 24-hour period. Consequently, critical re-analysis of centrally produced synoptic charts was becoming a "lost art." Although the new 24-hr TAF responsibility was hailed by forecasters as a brilliant and long-awaited move, it inherently required greatly increased forecaster proficiency. Once more, the additional burden to do more with less fell primarily on the detachment.

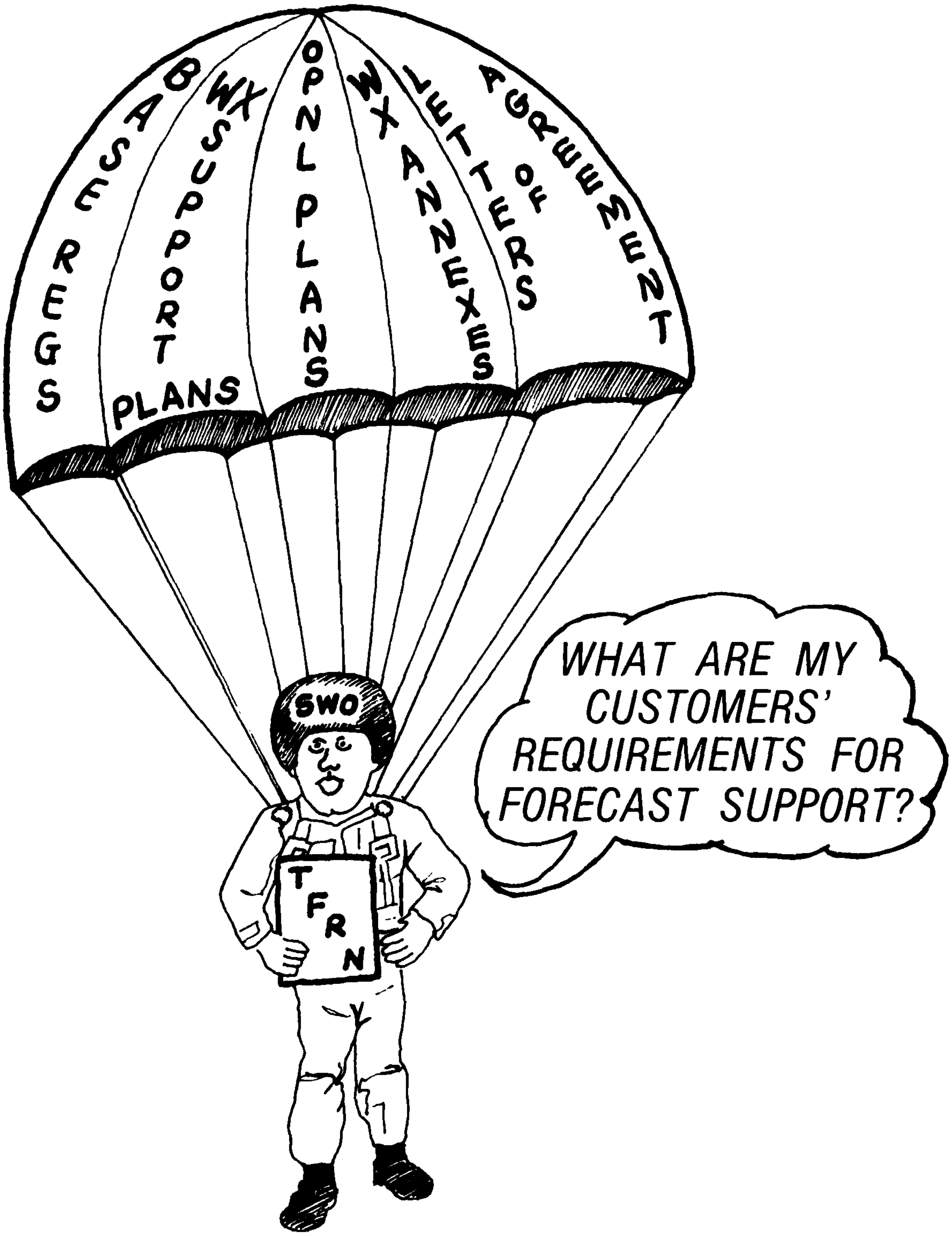
NEW FORECASTING REQUIREMENTS

With the advent of improved technical readiness requirements to satisfy rapid deployment forces and other wartime missions, weather-sensitive Air Force and Army electro-optical systems, satellite imagery, and probability forecasting--to mention only a few--comes the need for a broader, more in-depth understanding of meteorology. Again, a solid, well-integrated local training program becomes a necessity. And you, the detco, may be the only person in your unit with the technical education required to implement a meaningful program. Unquestionably, you must be the leader of such a training effort.

WRAP UP--ON THE BRIGHTER SIDE

One note of optimism that overshadows all adverse trends: the most important aspects--the "brains" and "guts"--of our forecasting force has not deteriorated. If anything, we've improved. AWS continues to be blessed with some of the most intelligent and highly dedicated members in the Air Force. Therefore, with unabated potential at your fingertips, your challenge is to develop and motivate these forecasters. To do this you must (1) establish unequivocally that outstanding forecast support is what your forecasting section is all about and (2) be the impetus for providing such support. But how? Please read on!

CHAPTER 3



BASE REGS
WX SUPPORT PLANS
OPNL PLANS
WX ANNEXES
LETTERS OF AGREEMENT
SWO
TFRN
WHAT ARE MY CUSTOMERS' REQUIREMENTS FOR FORECAST SUPPORT?

CHAPTER 3

WHAT ARE MY CUSTOMERS' REQUIREMENTS FOR FORECAST SUPPORT?

Before you can determine whether your detachment is providing the best technical forecast support possible, you must know each of your customer's various requirements for support. You're right--that's no easy task! So where do you begin? Well, this is where you take off your "detco hat" and slip on your "staff weather officer (SWO) hat." You might use the following "roadmap."

STATED REQUIREMENTS

Review your stated customer requirements for weather support. These are generally listed in one or more of the following places:

• A base directive outlining local weather support requirements.

• A local weather support plan.

• Letters of agreement, usually between your detachment and non-local organizations requiring support.

• Operational plans and accompanying weather annexes describing weather support requirements during a contingency/war or a natural disaster (i.e. the base disaster preparedness plan).

ACCURACY OF STATED REQUIREMENTS

Verify whether the requirements are accurate and up-to-date. For example, have significant changes in your customer's missions occurred? If so, is the

current weather support agreement adequate? This will often require a visit to various organizations your unit supports. It also provides an ideal opportunity to cultivate rapport with your customers by demonstrating you take a personal interest in their operations and genuinely desire to provide the best possible weather support.

TRANSLATING REQUIREMENTS INTO SUPPORT

(Ref: 5WWR 80-1)

You should insure that all unclassified stated requirements are translated into meaningful weather support terminology, consolidated, and kept at the fingertips of your forecasters. An ideal approach is to integrate the information into your Terminal Forecast Reference File (TFRN). In any case, you should identify the weather that impacts each of your customer's operations and include specific threshold values established by the customer. For instance, a wind speed of 35 knots may be a threshold value for a particular customer.

The following outline is used at many units and works quite well:

1. Unit or activity supported. List on a separate page each organization that is impacted by weather. For simplicity, the unit listed should be the one that makes the decisions when a threshold value of a weather element is observed or forecast. For example, in an air base wing, separate sheets may be included for base operations, civil engineers, maintenance control, etc.

2. Customer operations involved. List the customer's mission, operation, or activity that is impacted by the weather.

3. Weather impact.

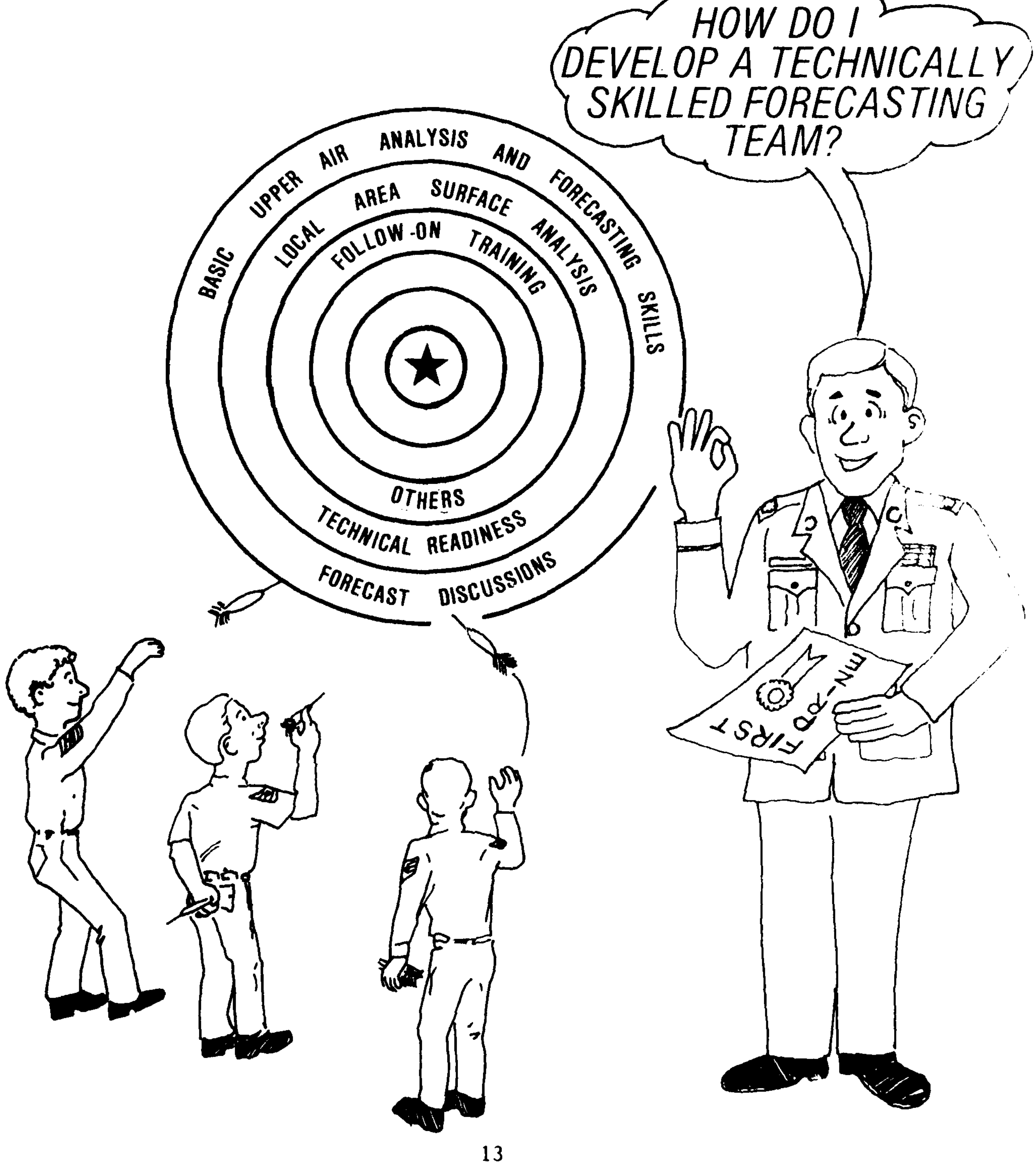
a. List the critical elements and threshold values that the customer identified as having an adverse impact on his operation.

b. List the actions the customer takes when threshold values of critical weather elements are observed or forecast. For each threshold, specify the customer's desired lead time.

FORECASTER FAMILIARIZATION

Last--but not least--each of your forecasters must be intimately familiar with the consolidated set of unclassified weather support requirements identified. More important, forecasters should thoroughly understand their classified (contingency/wartime) support responsibilities, documented separately.

CHAPTER 4



HOW DO I DEVELOP A TECHNICALLY SKILLED FORECASTING TEAM?
BASIC UPPER AIR ANALYSIS AND FORECASTING SKILLS
LOCAL AREA SURFACE ANALYSIS
FOLLOW-ON TRAINING
OTHERS
TECHNICAL READINESS
FORECAST DISCUSSIONS
FIRST

CHAPTER 4

HOW DO I DEVELOP A TECHNICALLY SKILLED FORECASTING TEAM?

As mentioned in Chapter 2, today's forecasters are overflowing with potential and dedication--but often lack adequate formal training and experience. Therefore, you must insure your bright young forecasters reach their full potential--and pass the benefits on to your customers. The way to accomplish this is through continual training and teaching, which leaves you less time to shuffle papers --a difficult but necessary priority you must establish. Such a forecaster training program involves a three-pronged approach:

- Daily practice and discussions of <u>basic</u> upper air and surface analysis and forecasting techniques.

- The study of supplemental materials, such as applicable AWS follow-on training seminars.

- Becoming technically ready to perform the wartime mission in the combat area your forecasters are tasked to support.

BASIC UPPER AIR ANALYSIS AND FORECASTING SKILLS

(Primary Ref: AWS FOT Seminar STT-Q9-0004, "Back to Basics")

Understanding what's happening "up there" is <u>THE KEY</u> to explaining the weather occurring at the surface. <u>By itself</u>, even a very basic upper air analysis--if completed skillfully--will reveal a 4-dimensional (space and time) picture of the atmosphere; the location, direction of movement, and speed of jet streams, principle storm tracks, and fronts; whether systems are

strengthening or weakening; the possibility of adverse weather affecting your local area--and more. However, centrally-produced upper air charts, alone, provide only a limited computer analysis (or mis-analysis). Consequently, to obtain the valuable weather intelligence available, your forecasters must analyze--or reanalyze--the key centrally produced upper air analyses. The most important are the 850-, 500-, and 300-mb charts. Sometimes the 700-mb chart is also invaluable. Therefore, it is essential that your forecasters become proficient at analyzing these charts and that they routinely extract the intelligence the charts contain. Following are basic fundamentals about the upper atmosphere that all your forecasters must understand and be able to apply routinely.

· 850-mb Analysis.

·· Primary use: To accurately locate and forecast the movement of polar fronts, occlusions, and associated lows and highs.

·· Advantages over surface analysis:

(1) Fronts are usually easier to pinpoint at 850 mb than at the surface (except in mountainous regions). This is partially because there is little terrain influence. Also, temperature fluctuations caused by diurnal heating and cooling are much greater at the surface than at 850 mb. Thus, it becomes more difficult to separate the synoptic from diurnal variations when locating the surface front.

(2) Frequently, a so called polar "front" analyzed on the National Meteorological Center (NMC) Surface Chart has no thermal support at 850 mb. If the "front" cannot be found at 850 mb, it is extremely weak or doesn't exist, since strong polar air masses are identifiable at 850 mb.

(3) Fronts can be verified and tracked at 850 mb using continuity (discussed later). This is because fronts do not normally appear and then dissipate within 12 hours. (NMC "fronts" often violate this rule.) Consequently, if an 850-mb front doesn't have continuity, BEWARE--it must be very weak, non-existent, or just forming.

·· How to locate 850-mb polar fronts:

(1) At 850 mb, polar fronts are typically located between the 5°C and 10°C isotherm in the winter, and between the 10°C and 15°C isotherm in the summer. (See Figure 4.1.) This is a good place to lightly sketch in the front as a first guess. It marks the boundary between polar and tropical air.

(2) At 850 mb, the polar front is located parallel to and on the warm side of the thermal packing. (See Figure 4.1.)

(3) The 850-mb polar front is always on the cold air side of the surface front, since fronts slope toward the cold air with height. (See Figure 4.2.)

(4) One of the best tools available to pinpoint whether a front has passed a station is to compare the 24-hour change in the 850-mb temperature at specific stations in the vicinity of the frontal zone. This technique, although extremely effective, is seldom used. (Looking at 24-hour rather than 12-hour changes diminishes diurnal effects.)

(5) Wind direction shifts (e.g., from 230° to 300°) at 850 mb can help determine frontal locations.

(6) Continuity is probably the single best tool to verify the existence and position of an 850-mb front. This is because fronts are conservative--i.e., they don't normally form and then dissipate within 12 hours. Also, they tend to intensify or dissipate and speed up or slow down in a manner that's predictable if one effectively uses continuity.

·· How to locate 850-mb occlusions:

(1) Typically, the occlusion lies in the thermal ridge. This is consistent with the warming observed ahead of an occlusion and gradual cooling behind it. (See Figure 4.3.)

(2) The point of occlusion (triple point) at 850-mb lies almost directly beneath the polar maximum wind (polar jet) at 300 mb. That is, the 850-mb front is occluded north of the 300-mb polar jet. (See Figure 4.4)

(3) Continuity of occlusions: sometimes Pacific occlusions get "lost in the Rocky Mountains and suddenly "re-appear" east of the Rockies, producing unexpected weather. By keeping continuity at 850 mb, one can avoid such embarrassing surprises.

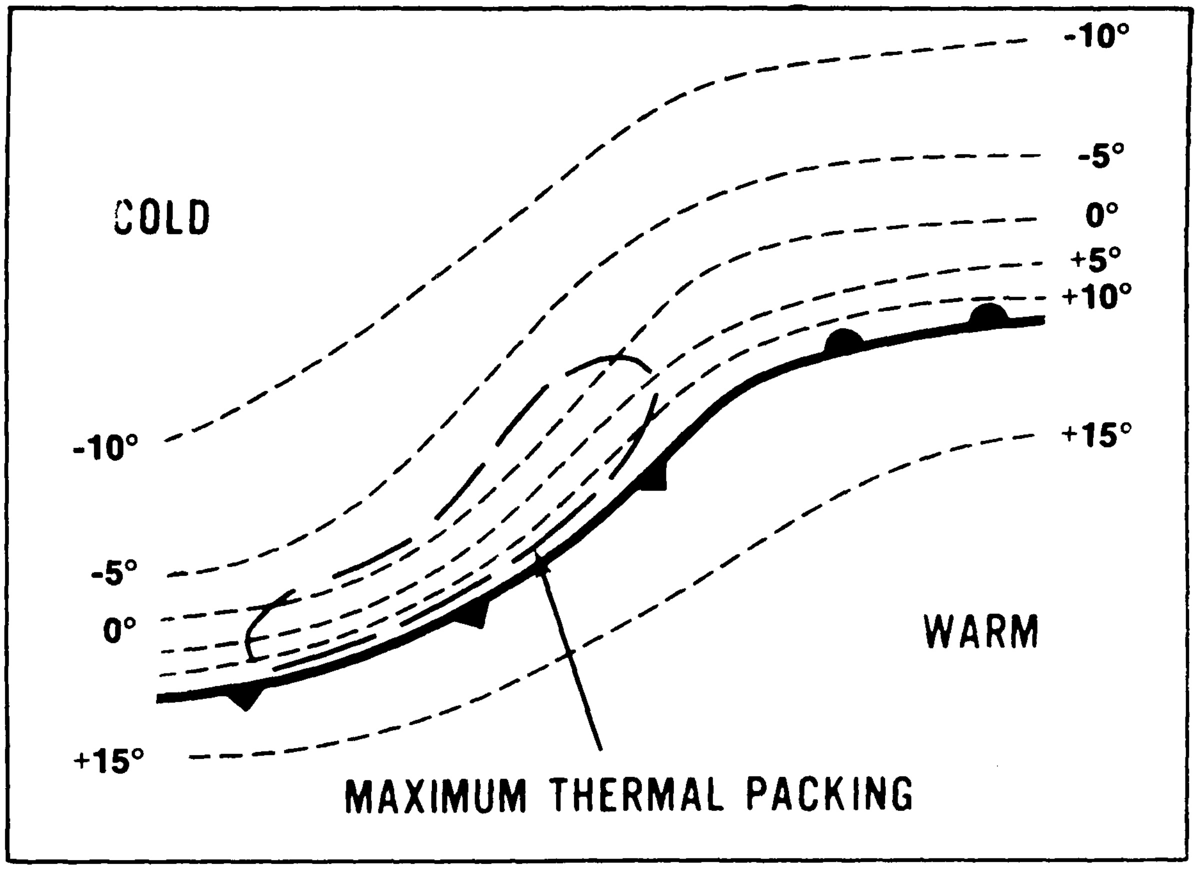


FIGURE 4.1. USING THE 850-MB ISOTHERM ANALYSIS TO LOCATE THE POLAR FRONT.

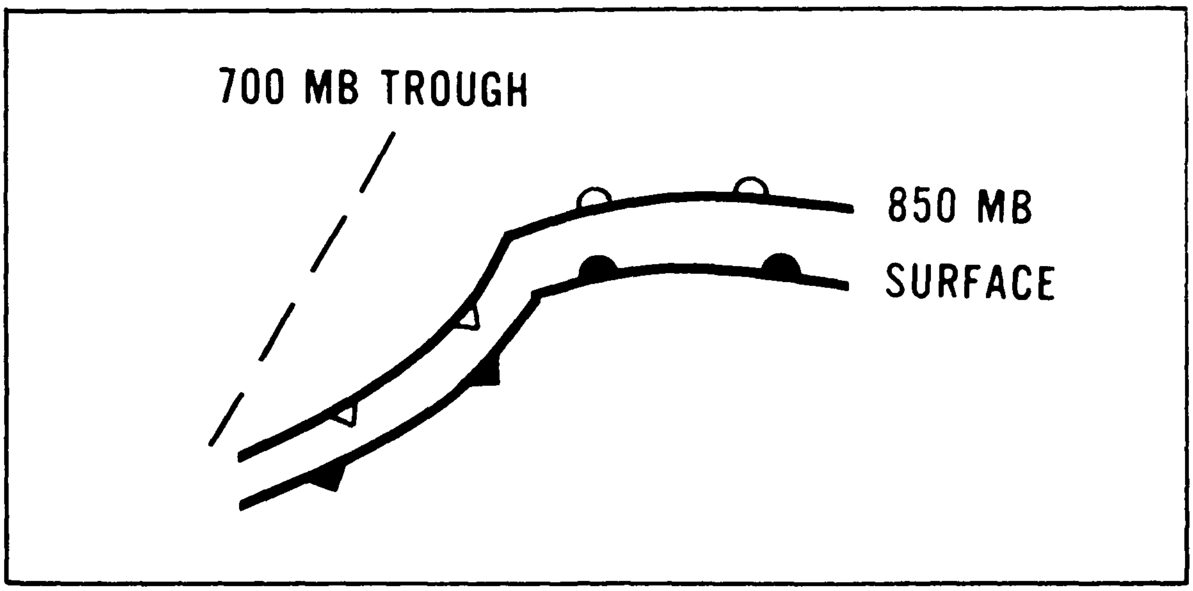


FIGURE 4.2. LOCATION OF 850-MB FRONT VERSUS THE SURFACE FRONT.

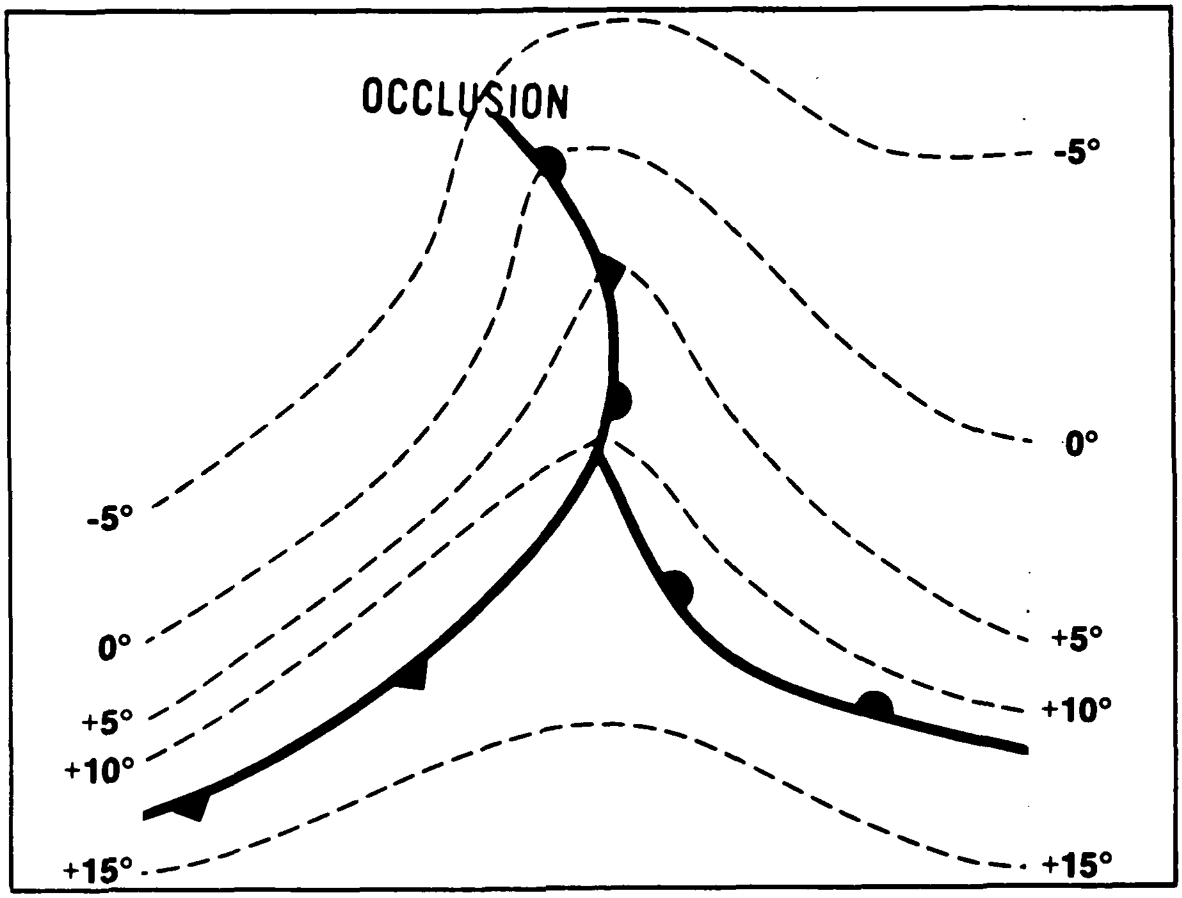


FIGURE 4.3. TYPICAL THERMAL PATTERN ASSOCIATED WITH AN 850-MB OCCLUSION.

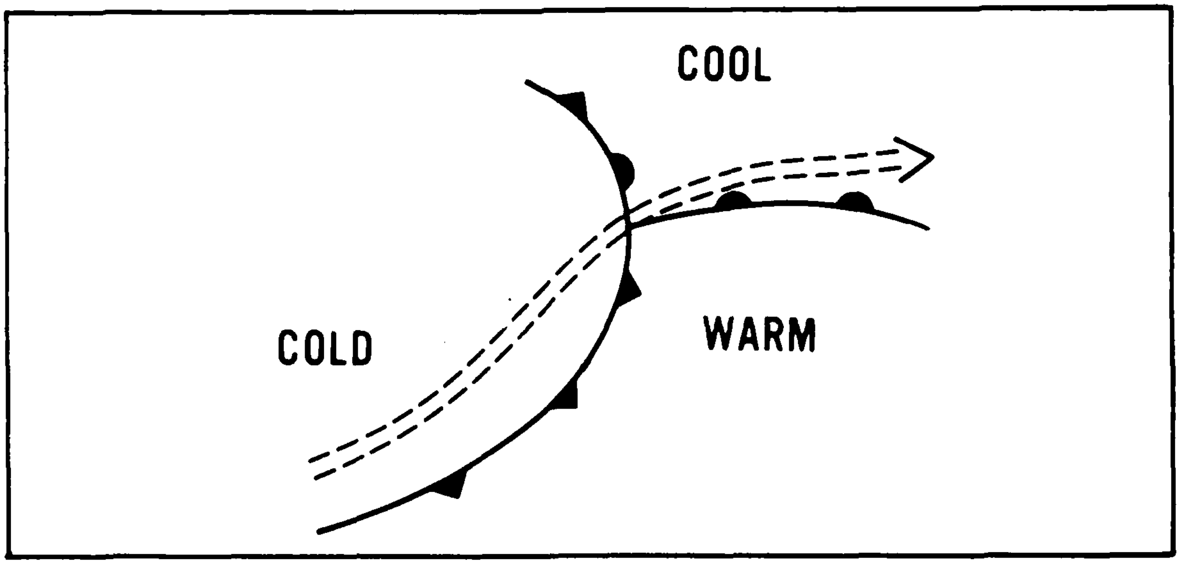


FIGURE 4.4 THE 850-MB OCCLUSION VERSUS THE 300-MB POLAR JET.

·· Other uses of the 850-mb analysis:

(1) Arctic Front. At 850 mb, the arctic front is typically located along the thermal packing between the -5°C and -10°C isotherms. The arctic front specifies the boundary between the very cold, dense arctic air and warmer, less dense polar air to the south. Using the -5°C or -10°C isotherm to depict and maintain continuity of the arctic front during the winter will help locate likely areas of snow and improve minimum temperature forecasts.

(2) By pinpointing regions of strong low level warm (or cold) advection at 850 mb, the forecaster can locate potential areas of upward vertical motion and decreasing stability or vice versa.

(3) Low level wind maxima and moisture sources provide valuable information on potential severe weather areas.

· 700-mb Analysis -- Primary Uses.

·· To identify 700-mb trough and ridge positions and establish vertical consistency (stacking) with surface and 850-mb features.

·· To spot *mid-level moisture, which indicates potential clouds.* Also, if mid-level moisture is stacked with low-level moisture, precipitation is likely.

· 500-mb Analysis -- Primary Uses.

The synoptic features at 500 mb--if carefully analyzed--will provide extremely valuable information about the weather above and below that level. Several basic points must be understood and routinely applied in concert to effectively use the 500-mb analysis.

·· Contour troughs:

(1) Major and minor troughs are good indicators of existing or potential adverse weather.

(2) Below 500 mb, the region ahead of a 500-mb trough is usually an area of upward vertical motion (positive vorticity advection).

·· Height analysis:

(1) Areas of significant height falls are associated with upward motion, troughing, and convective activity.

(2) Areas of significant height rises are associated with subsidence, enhanced surface ridging, and stability.

(3) During the winter, 500-mb height falls of 60 meters or greater indicate a strong trough with probable adverse weather. Also, 60-meter rises signal a rapidly building ridge.

(4) During the summer, height falls of 30 to 50 meters often indicate a significant, weather-producing trough.

·· Temperature analysis:

(1) Below 500 mb, an area of warm advection ahead of a trough is associated with upward vertical motion (instability).

(2) Below 500 mb, an area of cold advection ahead of a ridge is associated with downward vertical motion (stability).

(3) If a thermal trough at and below 500 mb lags behind the contour trough, deepening of the system should be expected. If the thermal and contour troughs are in phase, deepening is unlikely.

(4) 500-mb winter temperatures colder than -30°C indicate a strong trough and potentially adverse weather.

·· Moisture analysis: Small pockets of moisture at 500 mb (not associated with thunderstorms) indicate that upward vertical motion may exist. Advection of this area over an unstable area below might cause convective activity or a low to develop.

·· Continuity: The 500-mb level is an ideal level to keep continuity on the movement and intensity changes of troughs and ridges. A good way to track the movement, amplitude, and intensity is to keep continuity on a representative height contour, e.g., the 558 contour line.

· <u>300-mb Analysis</u> -- <u>Uses</u>.

·· Primary use: To locate and maintain continuity of the band of polar maximum winds (polar jet). This is an extremely valuable piece of information since the polar jet is directly linked with principle storm tracks and frontal zones. Three important rules follow:

(1) The primary storm tracks lie almost directly beneath the polar jet.

(2) The polar front at 850 mb is displaced equatorward of the polar jet. (Refer back to Figure 4.4.)

(3) The polar jet lies almost directly above the point of occlusion (triple point of an occluded front) at 850 mb. (Refer back to Figure 4.4.)

·· Another valuable use: To locate areas of upper level diffluence and confluence. Upper level diffluence (which enhances upward vertical motion) is associated with wind direction or speed divergence at 300 mb. Conversely, upper level confluence (which enhances downward vertical motion/subsidence) is associated with 300-mb wind direction or speed convergence.

· Continuity. Although usually not included in theoretically-oriented meteorological textbooks, omitted from facsimile charts, and not fully integrated into numerical models, continuity is probably the most fundamental and powerful analytical tool available. Three uses are listed here:

·· Keeping continuity helps your forecasters visually track the movement and changes in intensity of significant weather features.

·· Continuity can be used to track changes in the position of isotherms and contours as well as fronts, lows, troughs, and ridges.

·· Maintaining continuity assists fellow forecasters who will work the next shift.

Two important points regarding continuity must be kept in mind:

·· Follow the "Golden Rule of Continuity," i.e., "Continuity must be preserved." Adjustments are sometimes necessary, but CAUTION! Don't violate the "Golden Rule" and break continuity without strong justification. Why? Because synoptic systems are conservative (i.e., they don't routinely appear and then disappear within 12 hours). Since they sometimes are masked--e.g., by high terrain or a sparsity of data--continuity will help you "keep tabs" on them until they "reappear."

·· Use common sense, rather than blindly applying continuity. Specifically, always be alert to: (1) trend reversal, e.g., the time when a deepening system will begin to fill; and (2) recurvature, e.g., the place where

a low tracking south will begin recurving northward.

· Stacking. To have a complete 4-dimensional picture (space and time) of the atmosphere, the forecaster must visualize how systems are stacked. The basic rule to keep in mind is: lows tend to stack toward colder air aloft, while highs tend to stack toward warmer air aloft. (See Figure 4.5.) These stacking combinations are dynamically stable, i.e. the atmosphere "feels comfortable" with these stacks and will "try to maintain them."

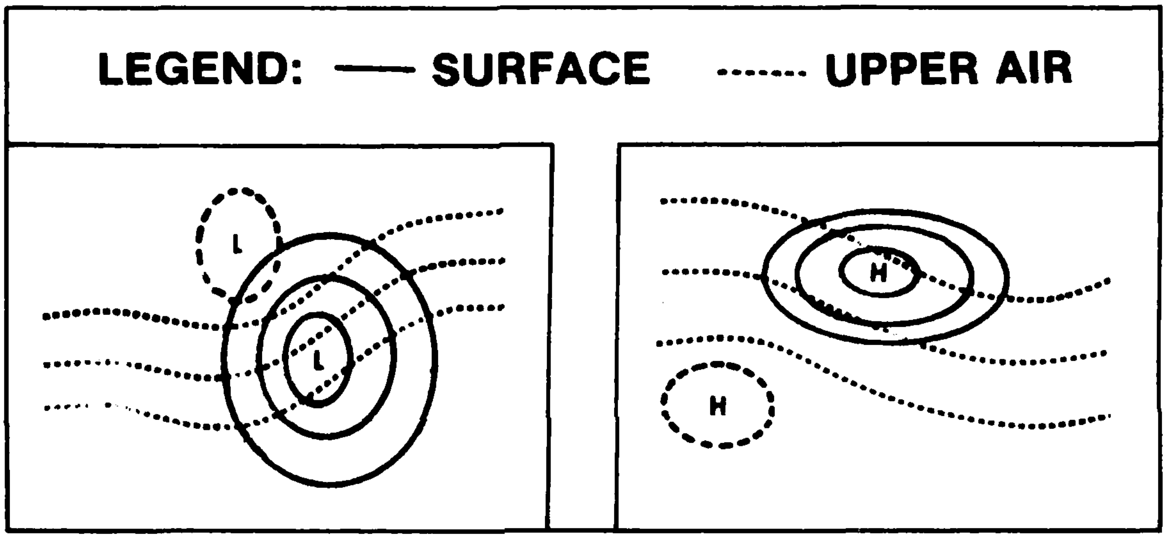


FIGURE 4.5. STACKING OF HIGHS AND LOWS WITH HEIGHT.

BASIC UPPER AIR ANALYSIS PROGRAM

How can your forecasters significantly improve their basic analysis and forecasting skills? By routinely applying the information discussed in the last section--a relatively simple but critical requirement. How can they apply it? The program described below (with minor modifications) was developed at 5th Weather Wing in 1978 to combat forecaster inexperience and lack of training. Visits to units implementing the program consistently confirmed that such a "back-to-basics" approach greatly improves forecaster expertise, confidence, and performance. The procedures stress aggressive analysis and reanalysis of the 850-, 700-, 500-, and 300-mb charts--instead of over-dependence on centralized progs and forecasts. Following is an extremely effective and efficient way to administer the program:

· First, have each forecaster begin by carefully reviewing the previous section on basic upper air skills.

· Next, have your forecasters carefully review AWS Follow-on Training Seminar STT-Q9-004, "Back-to-Basics" (a slide and tape seminar was sent to all AWS forecasting units in 1979). Three or four forecasters reviewing and discussing the seminar as a group often motivates interest and clears up questions regarding the material.

· Then, with the above two sources as ready references, implement the analysis procedures in the "Upper Air Analysis Checklist," included as Figure 4.6. (Your forecasters should carry this checklist in their "hip pocket" until the procedures become "automatic.") The duty forecaster should--as a minimum--routinely complete the analysis checklist at 12-hour intervals if at all possible. THIS PRACTICE IS OF UTMOST IMPORTANCE. Also it should be done for as large an area as possible, e.g., the eastern two-thirds of the United States. Besides improving the forecasters' ability to forecast at your station, it also will prepare them for other mid-latitude locations. Most importantly, this effort, if done routinely, will vastly increase your team's technical readiness to support its wartime mission--which is what we're "all about." The <u>bottom line</u> is: although analysis procedures may have to be adjusted with surges in workload and geographic location, they must never be neglected since they are <u>essential</u> for forecasting excellence.

Note that Figure 4.6 was extracted from a more exhaustive "Checklist of Analysis Options...," included as Appendix 1. This checklist, although longer, is preferable when time permits.

LOCAL AREA SURFACE ANALYSIS

(Ref: AWSR 105-22, 5WWP 105-8)

As just pointed out, you must continually emphasize the unparalleled importance of a detailed local analysis of the 300-, 500-, 700-, and 850-mb facsimile charts. This develops skill in understanding large scale (subsynoptic scale to lower macroscale) systems and circulation patterns. However, there

FIGURE 4.6. UPPER AIR ANALYSIS CHECKLIST. (REF: 5WW/FM-80/001)

<u>300-MB (or 250-MB) ANALYSIS:</u>

1. Highlight the location of the maximum wind band(s) (RED ARROW). Be careful to distiguish between the polar and subtropical jets.

2. Maintain continuity on the location of the maximum wind band (YELLOW).

3. Use the location of the maximum wind to determine:

   a. Primary storm tracks;
   b. Proper location of the triple point along occluded frontal systems;
   c. Areas of upper level diffluence and confluence.

<u>500-MB ANALYSIS:</u>

1. Maintain 24-hour continuity of troughs, lows, ridges, highs, and significant height fall centers (YELLOW).

2. Sketch major trough and ridge features (PENCIL).

3. Examine the 12-hour height change field. Mark significant (e.g., $\geq$ 50 meters) height fall and rise centers (PURPLE) and follow continuity on the height fall centers (YELLOW). Also use the height change fields to refine trough and ridge positions.

4. Finalize analysis of trough and ridge features (BLACK).

<u>700-MB ANALYSIS:</u>

1. Maintain 24-hour continuity of troughs, ridges, highs, and lows (YELLOW).

2. Analyze trough and ridge features (BLACK). Check stack with 500-mb and 850-mb features before finalizing the analysis.

<u>850-MB ANALYSIS:</u>

1. Mark 24-hour temperature changes in the vicinity of suspected frontal zones (PENCIL).

2. Maintain 24-hour continuity of highs, lows, fronts, and when appropriate, troughs & ridges (YELLOW).

3. Highlight key isotherms, being careful to check the accuracy of the machine analyses (RED).

4. Sketch your "first guess" of polar and arctic frontal locations (PENCIL).

5. Mark areas of strong cold (thin BLUE arrow) and warm (thin RED arrow) air advection.

6. Finalize analyses of polar and arctic fronts (BLACK). Insure that the upper tropospheric wind maximum supports your analysis and that you have reasonable stack with 700-mb and 500-mb troughs.

is also the need to develop and apply skills which will provide a more detailed analysis over your more limited "local" area of responsibility. The local area surface analysis fulfills this need by improving the frequency, timeliness, and scale of analysis. It "blows up" the picture relating to important pressure systems, fronts, and weather elements affecting your local area. In addition, it allows you to follow closer continuity on local weather systems. (See Figure 4.7 for a comparison of scales.)

Local Analysis:	← - - UPPER AIR - - → ← - - SURFACE - - →			
SCALE:	micro	meso	synoptic	macro
SPACE:	1 NM	500 NM	1500 NM	
TIME:	seconds to a few minutes	tens of minutes to several hours	tens of hours to several days	several days to over a week

FIGURE 4.7. SCALES OF WEATHER SYSTEMS. (REF: 5WWP 105-8)

Figure 4.8 (next page) is a sample SOP on requirements for analyzing local area surface charts (LASCs). You might consider some variation to this which best suits your needs and still accomplishes the end result -- improved forecaster exnertise and refined TAFs.

FORECAST DISCUSSIONS

(Ref: AWSP 105-56)

• Purpose. Forecast discussions serve two main purposes: (1) to improve customer support by drawing from individual and corporate forecaster knowledge; and (2) to enhance forecaster expertise and knowledge through maximum participation and free exchange of ideas and experience.

• Who Should Participate. The duty forecaster should lead the discussion. Your station chief and all available forecasters should participate. Your observers -- AWS' future forecasters -- should be strongly encouraged to attend and participate. But most importantly, YOU must actively participate

FIGURE 4.8. SAMPLE SOP ON LASCs.

LOCAL AREA SURFACE ANALYSIS REQUIREMENTS DATE: 1 MAR 81

1. One complete LASC (for 0900Z) will be analyzed each day for proficiency training and use in preparing 1200Z TAF.

2. Draw isobars for 2 millibar increments (exception: 1 or 4 when appropriate for weak or strong pressure gradients) and include the 1000-mb isobar in the analysis.

3. Enter fronts, instability lines, troughs, ridges, and pressure centers in the appropriate color scheme and method contained in AWSR 105-22.

4. Color the present weather in the manner and appropriate color indicated in AWSR 105-22.

5. Perform a nephanalysis for ceilings and visibilities--below 1000 feet and/or 3 miles in red, and below 3000 feet and/or 5 miles, but equal to or greater than 1000 feet and 3 miles in blue.

6. Enter in black ink at least two past positions of the surface features listed in paragraph 3 above, and connect these past positions to the current position with a dashed line. Enter the time in two digits above the pressure center symbol and the pressure in whole millibars below the pressure center symbol. Past positions may be extracted from facsimile charts when no work charts are available.

7. Enter 6- and 12-hour forecast positions of these surface features in black pencil and connect the current pressure center position to the forecast positions with a solid arrow along the path which the pressure center is expected to take. Enter the valid time and pressure in the manner described above.

8. Explain reasons for breaks in continuity, unresolved analysis, problem areas, etc. These will be noted on the chart.

daily--and, on occasion, conduct the discussion. Why? Because you are the technical leader and must visibly cultivate that responsibility. Your enthusiasm will be the catalyst to motivate your team. In addition, your expertise may be valuable in resolving problem areas and correcting deficiencies you may spot.

• Contents. The discussion should normally begin with the "big picture." For training purposes, a routine discussion of weather patterns across the whole CONUS presents an extremely valuable learning/teaching opportunity.

Look at the upper air first (e.g., the 300-mb maximum winds, etc.) and work down. Apply the "intelligence" gained from the completed upper air and surface analyses described previously. AWSP 105-56, "Meteorological Techniques," provides a sample forecast discussion checklist which you may want to refer to when constructing your checklist.

AWS FOLLOW-ON TRAINING (FOT) MATERIALS

(Ref: AWSR 50-5)

• Philosophy. As mentioned in Chapter 2, the AWS/CC formally emphasized the need for an AWS FOT Program in 1979. The reasons were obvious: a compressed enlisted forecaster course, drastic decreases in experience, and the reinstituted 24-hour TAF--to mention a few. Thus, HQ AWS and its wings have combined their intense efforts to develop useful FOT materials. AWSR 50-5, "Follow-on Training" formally establishes the program.

• Purpose. The program is designed to help forecasters increase their knowledge and proficiency through a continual study of FOT materials tailored to the needs of today's forecasters. FOT materials supplement--but do not replace--daily practice of basic analysis and forecasting skills using "real-time" data. Combined, however, these two "arms" of training spell "forecaster expertise." The end result is enhanced peacetime as well as contingency/wartime weather support to AWS customers.

• Information Available. The primary emphasis has been on slide/tape seminars. Your detachment should have a complete library of these (numbering about 25 by early 1981). Semi-annually, AWS/DOT publishes in the AWS Operations Digest, the list of FOT seminars completed. (If you have an incomplete set, contact your squadron for assistance.) Among others, the FOT seminars listed below are excellent:

- "Back-to Basics"
- "Terminal Forecasting"
- "Assessment of Numerical Weather Prediction Using 'GOES' Satellite"
- "AWS Radar Fundamentals and Severe Storm Detection"
- "Meteorological Satellite Interpretation"
- "Back to Basics II, Blocks I and IIc"

· How to Organize Your Local FOT Program. AWSR 50-5, para 3c(1) states, "All AWS units will insure FOT programs are used." You should not interpret this to mean you must establish a time-consuming, burdensome "paper program to satisfy higher headquarters." Instead, it should be organized to accomplish two training objectives: (1) improve forecaster knowledge, expertise, and basic technical skills; and (2) technically prepare forecasters to perform their wartime mission (discussed in the next section). Your materials must be readily accessible to allow the duty forecaster to routinely study them as time allows. Figure 4.9 suggests guidelines for organizing your FOT materials. However, it's your detachment and the decision on how to best organize your program is--rightfully--yours.

FIGURE 4.9. SUGGESTED GUIDELINES FOR ORGANIZING YOUR FOT MATERIAL.

1. Consider the following when organizing seminars for use:

   a. Do they apply to the peacetime mission (all forecasters)?

   b. Do they apply to the wartime mission (specific forecasters)?

   c. Should they be shown seasonally?

   d. Should they be shown to new forecasters?

   e. Are they "not applicable"?

2. Keep the parts of the seminar (script, tape, and slides) together and organized. A central location for all the seminars is a good storage option.

3. Keep an index of seminars on hand. Update the index as each new seminar is received.

4. Review new FOT seminars as time and local priorities allow. There is no requirement for the commander or station chief to review seminars as soon as received. Feel free to use a duty forecaster as the first reviewer.

5. Administer the training with the individual in mind. Some forecasters learn more when working alone while others learn best in a group.

TECHNICAL WARTIME READINESS/MOBILITY TRAINING

(Ref: AWSR 55-2; 5WW Technical Readiness Report, Jan 80)

• Philosophy. AWSR 55-2, "AWS Tactical Weather Support," states: "...AWS people must be organized, equipped, and trained to support tactical organizations at all levels of conflict..." Further, "... AWS must ... train its people for war and contingency operations..." Where does this happen? At your detachment--WHERE THE "RUBBER MEETS THE ROAD." And you, the detco, must insure your forecasters are technically and operationally ready to fulfill this awesome, but most vital, responsibility. This section will address the "technical" term in the wartime readiness "equation."

• Getting Technically Ready to Deploy "Over There." As mentioned before, nothing replaces practicing--daily--basic analysis and forecasting skills. However, preparing technically for war also involves a further step: each forecaster must become intimately familiar with the weather in the area where he/she will deploy, as specified in the appropriate operations or war plan. This effort must include becoming knowledgeable of the geography, terrain, climatology, weather regimes and typical patterns, weather data format (codes), density of data, and area weather peculiarities.

• "Contingency" Information Available.

•• HQ AWS Efforts: During 1980, HQ AWS--with the intense cooperation of its wings--made a superb effort to help detachments meet their technical wartime commitments.

(1) AWS published and sent to all its detachments 21 AWS Forecaster Memos (FMs) aimed at helping forecasters understand the weather in the Middle East, Africa, and Southwest Asia. The FMs cover geography, topography, weather patterns, climate, and effects of weather on weapon systems and personnel.

(2) To date AWS has published and sent out three outstanding "technical wartime readiness" seminars (and is working hard to complete others for potentially "hot" regions of the world):

TITLE
- "Seminar on European Theater Weather Orientation"
- "Weather and Its Effects: Arabian Peninsula Area"
- "Pacific Theater Weather Orientation, Part I"

·· CONUS Wing Efforts. In late 1978, 5th Weather Wing pioneered what has become an excellent CONUS wing program to get forecasters (and observers) oriented to the weather in the areas where they may be tasked to deploy during a contingency/war. The program included sending to CONUS units tailored weather packages, to include representative surface and upper air observations of various theaters (e.g., Europe, Africa, the Middle East, Western Pacific, and Carribean). This served a multitude of purposes. It provided weather codes, station locations, and "real" weather data to be plotted and analyzed. Further, it provided forecasters with experience in working with limited data--an anticipated combat reality. This program is currently being streamlined to make it even more valuable. The result will be enhanced technical readiness of our CONUS units.

· Your Detco Responsibilities. If you are not already getting your unit technically ready, consider the following:

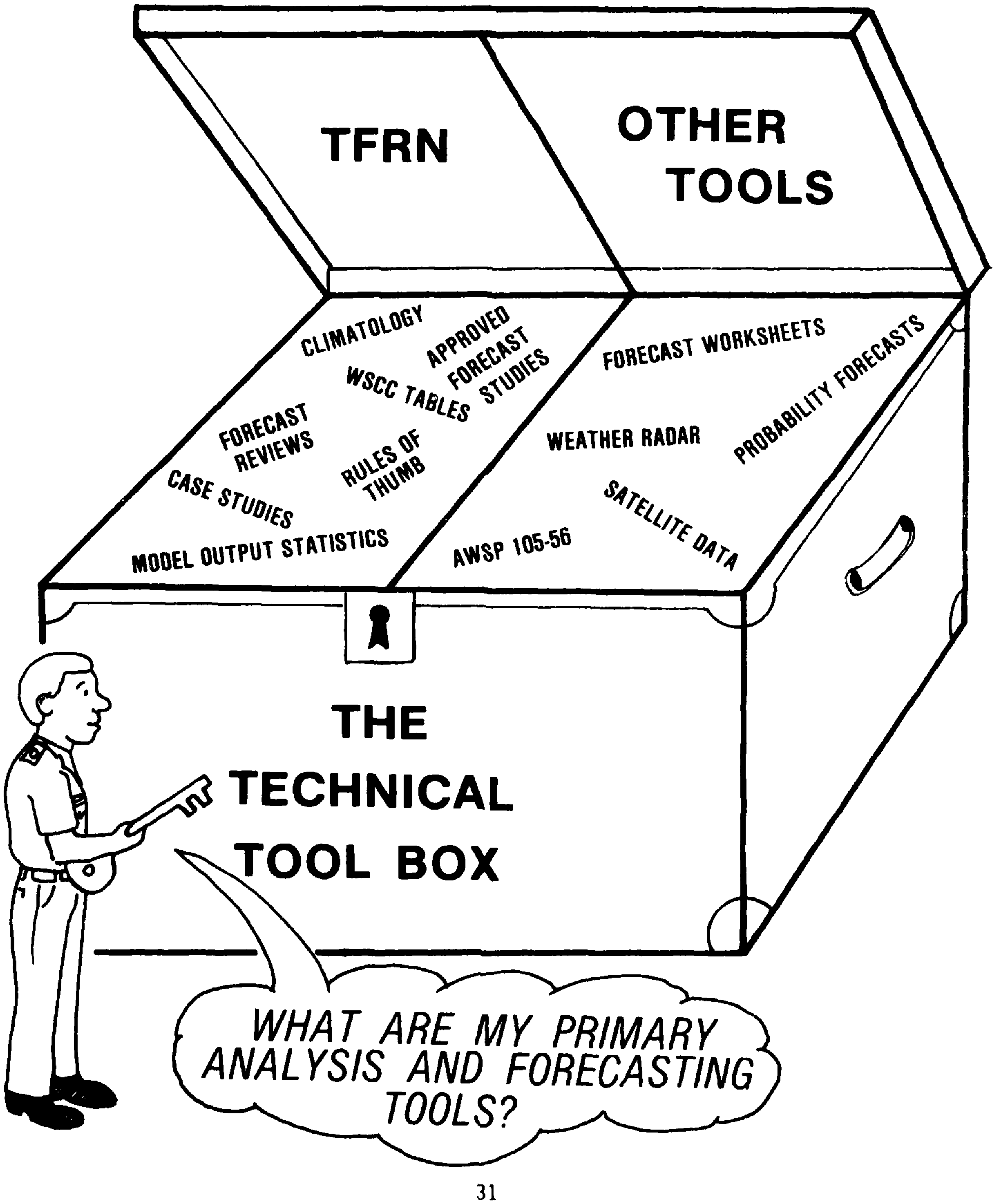
·· Clearly determine your wartime forecast support requirements.

·· Become familiar with the "technical readiness" information available from HQ AWS and its wings. (Your squadron can assist you.)

·· Organize a sound program to get and keep your team ready to support their customers during a contingency/war.

To summarize, preparing your forecasters to accomplish their wartime tasking is your most important function--especially in today's environment.

CHAPTER 5


TFRN
OTHER TOOLS
CLIMATOLOGY
APPROVED FORECAST STUDIES
WSCC TABLES
FORECAST REVIEWS
RULES OF THUMB
CASE STUDIES
MODEL OUTPUT STATISTICS
FORECAST WORKSHEETS
PROBABILITY FORECASTS
WEATHER RADAR
SATELLITE DATA
AWSP 105-56
THE TECHNICAL TOOL BOX
WHAT ARE MY PRIMARY ANALYSIS AND FORECASTING TOOLS?

CHAPTER 5

WHAT ARE MY PRIMARY ANALYSIS AND FORECASTING TOOLS?

CENTRALLY-PRODUCED LOCAL CLIMATOLOGICAL AIDS

An essential part of every forecaster's "tool box" is climatology. By routinely integrating the local climatology into every terminal forecast made, your team can--over the long haul--turn out far superior forecast support than if members ignore this key aspect of forecasting. Why? Because this weather "intelligence" is compiled from historical records of actual weather observations. Consequently, it is extremely useful in determining the "norm," extremes, and when a forecaster is "going out on a limb." Therefore, your forecasters must know what aids are available, how to use them, and when they apply. Two of the most useful centrally-produced climatological aids that can be applied locally are described below.

- <u>Wind Stratified Conditional Climatology (WSCC).</u>
  (Ref: AWSP 105-56, 5WW TN 78-1)

WSCC tables rank high among the most useful climatological aids available to the forecaster. If your unit doesn't have an updated set of WSCC tables, you should contact your squadron about obtaining a set from the USAF Environmental Technical Applications Center. These tables are based on the past history of weather <u>changes</u> at a given station. They give--for a particular wind direction sector and ceiling or visibility category--the probability of <u>that</u> particular category remaining or changing to another ceiling or visibility category. For more details, review AWS FOT Seminar STT-10-0374, "WSCC Tables."

• Model Output Statistics (MOS). Recent advances in computer technology and numerical modeling have allowed forecast products, which only a few years ago were considered beyond the state-of-the-art, to be generated routinely for use at local units. One of the most accurate and valuable products is MOS forecasts, currently being produced for many CONUS civilian and military stations. MOS integrates climatology and current weather. It includes forecasts of clouds, ceiling, visibility, precipitation, temperature, winds, and thunderstorms. If available for your station, you should encourage your forecasters to use this product--not to replace basic common "forecasting sense" but as an excellent supplemental tool.

LOCALLY DERIVED FORECASTING AIDS

Throughout the Air Force, frequent PCS moves result in a constant challenge to maintain continuity and retain corporate knowledge at the unit level. Your weather detachment is no exception. Nevertheless, there are proven procedures to capture forecaster knowledge and experience for posterity while improving your current support. Let's look at some of the best ways.

• Forecast Reviews.

(Ref: AWS/TN-79/002)

A forecast review is an after-the-fact "reanalysis" of weather information to document what went right or wrong with a particular forecast. It is to be used as an aid to predict future similar forecasting situations. The key feature of a forecast review is brevity. Generally, one should take less than an hour to complete.

Although the benefits of forecast reviews are widely acclaimed, technical consultant visits often uncover programs that do not accomplish the above goal. As the detco, you should make that determination--not a visitor. AWS/TN-79/002, "Forecast Reviews and Case Studies," is a good yardstick to judge your program's effectiveness. If it falls short of the mark, this technical note also provides the best guidance available on how to construct a meaningful program.

· Case Studies

(Ref: AWS/TN-79/002)

A case study is a more formal and in-depth reanalysis than a forecast review. Although both serve the same basic purpose--to improve forecasting effectiveness--the case study usually requires several hours of concentrated analysis. This often lays the ground work for arriving at valuable forecast hints and rules-of-thumb. You must emphasize the importance of case studies and motivate your team to develop them when the opportunity arises. Again, AWS/TN-79/002 provides excellent "how to" guidance.

· Rules of Thumb (ROTs).

(Ref: AWSR 105-29, AWSP 105-56, 5WWP 80-1)

These are concise statements that apply to a specific phenomenon and can be verified objectively. They are generally developed from "hints" or "hunches" based on experience. Their greatest value lies in their simplicity and ability to improve forecast accuracy. Therefore, you should encourage your forecasters to develop and verify the accuracy of meaningful ROTs. You should follow AWS, wing, and squadron guidance on the details. Some key guidelines follow:

·· Stress the quality--not the quantity--of ROTs.

·· Include the months and time of day to which the ROT applies (e.g., October - January/0500-0900 LST for a ROT on morning radiation fog).

·· Integrate ROTs into your forecast worksheet so they can be routinely applied and verified.

· Local Forecast Studies.

(Ref: AWSR 105-29, AWSP 105-56, 5WWR 80-1)

This discussion was intentionally left until last in this section. Why? Because that's its rightful place in the "pecking order." Before you try to solve an operationally significant forecast problem with a local forecast study, you should insure you have already tried a progression of more rudimentary methods to "get a handle" on the problem: forecast reviews, case studies, rules-of-thumb, and--simultaneously--a systematic approach to

forecasting using the basic fundamentals of meteorology discussed in the previous chapter. Then as a last resort, you might want to initiate a local forecast study. My pessimism is based on experience at the approval level which showed that such study efforts are manpower intensive, require a considerable amount of theoretical knowledge, and--worst of all--seldom yield useful results. Therefore, sound advice is, "If you have an approved forecast study of value, use it. However, if you don't, think long and hard (and touch base with your squadron/wing technical consultants) before "launching into one."

TERMINAL FORECAST REFERENCE NOTEBOOK (TFRN)

(Ref: AWSR 105-29, 5WWR 80-1)

One large compartment of the "tool box" is the TFRN, a reference "notebook" which contains many of the tools discussed above. When compiled properly, it will acquaint your newly assigned forecasters with the local weather, its impact on supported customers, and forecasting techniques to "get a handle" on how to forecast locally. Just as important, it will also serve as a ready reference for all you forecasters.

AWSR 105-29 "Quality in Forecast Products" describes the TFRN and its contents. 5WWR 80-1, "Terminal Forecast Reference Notebook and Technical Studies," provides excellent step-by-step guidance on how to prepare and maintain a TFRN. Figure 5.1 is a listing of the contents of a TFRN, as suggested in 5WWR 80-1.

FIGURE 5.1. OUTLINE OF TFRN CONTENTS.

CHAPTER

1. Location, Topography, and Local Effects
2. The Impact of Weather on Supported Units
3. Synoptic Climatology
4. Climatic Aids
5. Off-Base Support

APPENDIX

1. Operationally Significant Forecast Problems
2. Approved Forecast Studies
3. Rules of Thumb
4. Case Studies and Reference Material
5. Operational Verification

WEATHER RADAR

(Ref: FMH-7C)

The weather radar is one of the single most important local forecasting tools that your forecasters have to "see" the weather in the local area. As a met watch and short range forecasting tool, it provides continuous, detailed, and real-time coverage. Also, the "weather picture" it depicts is invaluable for weather briefings. Consequently, you must insure your local radar program is designed to integrate weather radar intelligence into observations, forecasts, briefings, and weather warning/met watch support. Hopefully your unit will have its own radar. If so, you must establish procedures to operate the equipment. Further, you must insure that both your forecasters and observers are trained as a team to effectively use this valuable resource. Each member of your team must be trained to take, encode, and interpret radar observations. If your unit doesn't have a weather radar, it must effectively use other available radar sources. The importance and scope of this program warrants your personal attention and selection of a radar coordinator. Your coordinator must be highly qualified to set up a sound radar program and teach others to operate the radar properly. Consult FMH-7C, "Weather Radar," on how to set up and maintain an effective program.

SATELLITE DATA

(Ref: AWSR 105-20, AWSTR 76-264)

During the past decade, satellite imagery has become the most revolutionary forecasting tool available. Meteorological satellites have dramatically improved the capability to observe the earth's weather. Technology has evolved to where weather satellites are now able to provide both visual and infrared photographs with resolution less than 1 mile. This results in both a day and night observing capability.

With the advent of weather satellites came the increasing use of cloud photographs as analysis and forecasting tools. The problem of data-sparse areas has been significantly reduced by timely satellite data. Further, satellites provide additional weather information which supplements conventional weather observations in locating systems such as fronts, ridges, troughs, hurricanes, typhoons, etc.

High-resolution satellite imagery can significantly enhance your customer support. If you are located in a data-sparse land area or along the coast, this tool may be a necessity rather than a luxury. AWSR 105-20, "Meteorological Satellite Direct Readout Operations," describes procedures for obtaining and effectively applying satellite data. Be sure you know what's available and how to get what you need. Just as important, insure your forecasters are properly trained to reap maximum benefits from this valuable tool. In addition to the guidance in AWSR 105-20, your squadron can assist you.

PROBABILITY FORECASTING

(Ref: AWSR 105-13, AWSP 105-51)

Although probability forecasting isn't the "cure for all forecasting ills," there may be occasions when it enhances your support. Consider the traditional categorical forecast. You must make a categorical--yes or no-- statement on whether an event will occur, even though you may know that an entire spectrum of possibilities exist. For example, you might forecast 7/8 cloud cover at 1,000 ft, while realizing there is an almost equal probability for 4/8 cloud cover at 2,000 ft. Although this difference may be operationally significant to your customer, categorical forecasts allow no way of conveying this uncertainty. Consequently, categorical forecasts limit customer decision making. On the other hand, probability forecasts partially overcome this "communication gap" by quantifying the uncertainty, thus enhancing your customers' decision making capability.

In short, you may have customers who would benefit from probability forecasts. However, before switching, you--the SWO--should insure your customer understands and is receptive to this type of support. The best advice is to proceed slowly, but proceed.

AWSP 105-56, "METEOROLOGICAL TECHNIQUES"

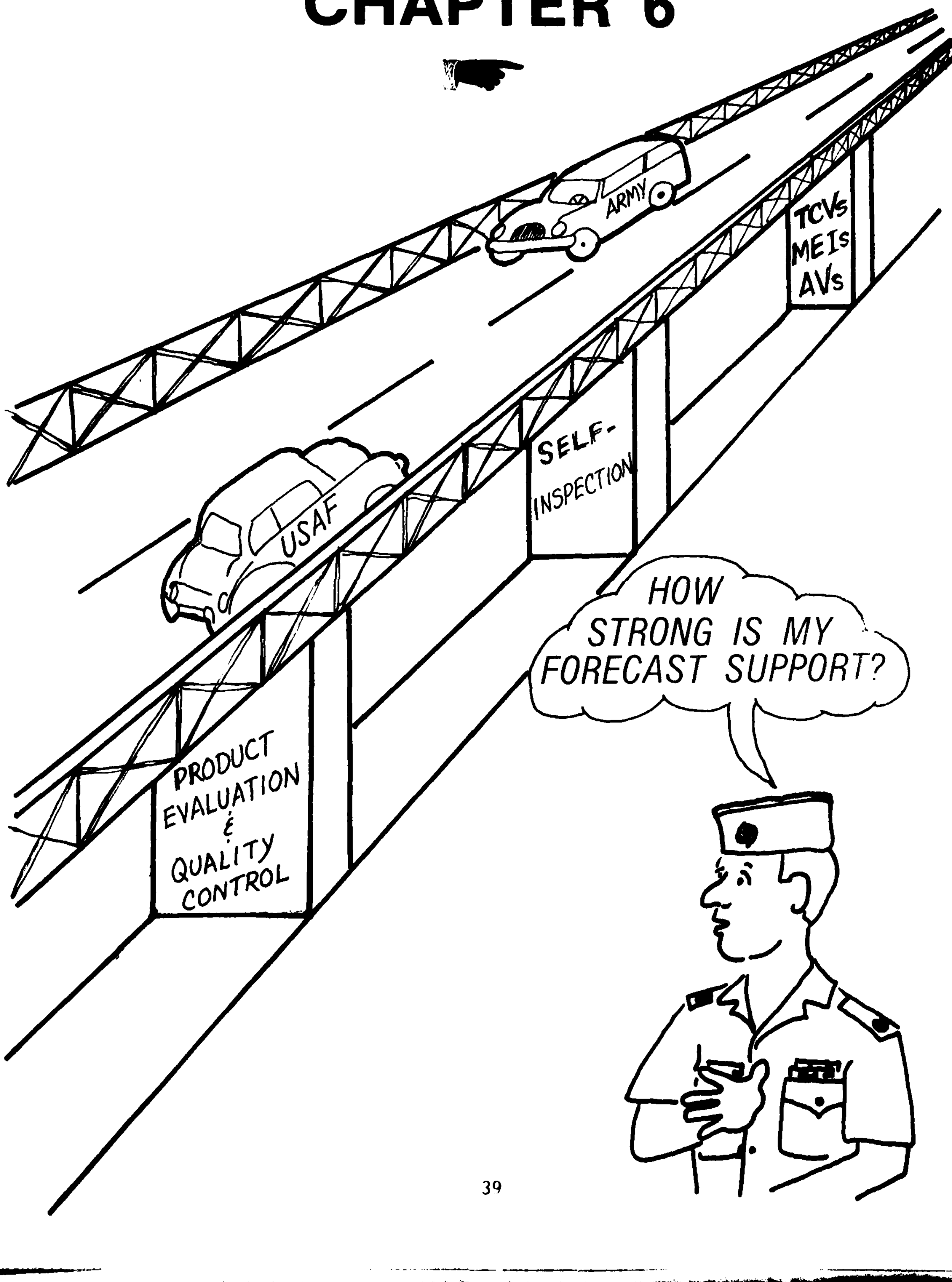
Your forecasting team should find this pamphlet an extremely useful reference. It is a catalogue of forecasting information and techniques obtained from various sources throughout the weather community. Much of the information can be easily adapted to your location. Therefore, your forecasters should be intimately familiar with and have ready access to this valuable tool.

FORECAST WORKSHEET--GETTING YOUR "KIT" TOGETHER

(Ref: AWSTR 218, 7WW/TN-80/001, 5WW SUP 1 to AWSR 105-22)

The vast majority of your forecasters' efforts culminate in the all-important end product--the terminal aerodrome forecast (TAF). Numerous decisions from flying critical missions to washing clothes are based on the TAF. But to produce this valuable product, the duty forecaster must consolidate all of the data gathered, tools used, and analyses performed. How does he fit all the pieces of the weather puzzle together, resolve the inconsistencies, and emerge with a winner--at least every six hours? Probably the most "foolproof" tool, even for the "old hands" is a good TAF worksheet. Although there are many approaches to developing a TAF worksheet, one overriding factor prevails: it must provide a concise, logical, and systematic procedure for preparing the TAF. AWSTR 218, "Preparation of Terminal Forecast Worksheets," provides details on designing a worksheet. Appendix 2 is a sample TAF worksheet.

CHAPTER 6



ARMY
TCVs
MEIs
AVs
SELF-
INSPECTION
USAF
PRODUCT
EVALUATION
&
QUALITY
CONTROL
HOW STRONG IS MY FORECAST SUPPORT?

CHAPTER 6

HOW "STRONG" IS MY FORECAST SUPPORT?

PRODUCT EVALUATION/QUALITY CONTROL

(Ref: AWSR 178-1)

An essential aspect of every technical service you provide is to know how well it meets the user's operational requirements. To obtain this information, you must establish a meaningful product evaluation/quality control program. Your goal should be to effectively and efficiently monitor the technical performance of your unit across the spectrum of forecast support provided. The program should (1) identify both the technical strengths and deficiencies of individual forecasters as well as the team as a whole, and (2) pinpoint the areas in which technical improvement is needed. The key ingredients of the program follow:

- A technical verification system to assess the "goodness" of terminal forecasts, local point warnings, and met watch advisories.

- Procedures to obtain informal and formal customer feedback regarding support.

- A streamlined management system to accomplish both on-the-spot and after-the-fact quality control.

- A monthly evaluation summary of your unit's evaluation/quality control results.

Each of these is addressed in more detail in the following paragraphs.

- Technical Verification.

·· Terminal Aerodrome Forecast Verification (TAFVER): The TAFVER program deals specifically with technical verification of ceiling and visibility forecasts. Analyses of TAFVER data often several valuable intelligence on positive or negative trends in forecast support. For example, do TAFVER statistics reflect possible weaknesses in your 3-, 6-, 12-, or 24-hour forecast? Is the problem related to time of day or season? TAFVER data can be effectively used as a management indicator of forecast performance. Then, if potential weak areas surface, more detailed analyses may be required to determine if, in fact, there is a problem. (Although used as "big picture" performance indicators by higher headquarters, your local TAFVER program is unquestionably more valuable to you and your forecasters.)

·· Local Point Warnings (LPWs) and Met Watch Advisories: There are specific weather conditions that endanger life or property, pose a safety hazard, or adversely impact your customers' operations. Your unit issues LPWs and met watch advisories to notify your customers when such conditions are forecast or observed. Because this support is extremely critical, every effort must be made to verify its quality and timeliness. That's the purpose of the LPW and met watch advisory verification program. Like TAFVER, this management tool can help pinpoint specific operational forecast problems, seasonal and diurnal trends, etc. Since such verification is so important, AWSP 178-1, "Product Evaluation," requires a local verification program. But, as with TAFVER, this must not become a square-filling exercise to satisfy higher headquarters--its purpose is to improve forecast quality and insure good customer support.

· Customer Feedback. Your ultimate mission is to fulfill your customers' requirements for weather support. Therefore, direct and reliable customer feedback--although it may be difficult to get--is of utmost importance. If your customers are happy, the quality of your support is probably "A-OKAY." (It goes without saying that if any are unhappy, you need to know that, also.) Now the tough question: How do you obtain such meaningful feedback?

·· Informal route: A good way to keep your "finger on your customers' pulse" is to establish close liaison and rapport with customers. Social

events provide an excellent opportunity. Although sometimes time-consuming, acquaintances made and knowledge gained often result in untold benefits.

•• Operational verification (OPVER): OPVER has become a "profane" acronym to many detcos and forecasters. However, if properly administered, it does not need to be. In fact, OPVER can provide information on the true value and "goodness" of your support that cannot otherwise be obtained (e.g., through TAFVER). Such customer feedback which directly links your support to mission success--or failure--provides an additional valuable tool to assess your support. AWSR 178-1, Chapter 3, provides the specifics, but three cardinal rules deserve mentioning here:

(1) Since the OPVER workload is substantial, OPVER must be reserved for only the most operationally significant support and performed within the constraints of your detachment's workload.

(2) OPVER must be conducted with a specific purpose in mind, not to provide "eye wash" for higher headquarters.

(3) Your OPVER program must not deteriorate into a prolonged "number generating" exercise. When its purpose is served for one problem, it should be terminated and a new problem attacked using OPVER.

What will the end result be? OPVER can help you prioritize your strengths and weaknesses so you can use your limited resources where the most payoff exists.

• <u>Quality Control</u> (QC). If your QC program is identifying problem areas and promoting improved performance, it is valuable. On the other hand, if it is a non-productive square-filling program--regardless of its sophistication--it must be modified. Remember, BIGGER IS NOT ALWAYS BETTER.

There are two distinct types of QC:

•• On-the-spot QC. This is a continuous process. Its purpose is aimed at eliminating procedural errors and insuring the technical quality of a product <u>before</u> it reaches the customer. This type of QC should comprise the <u>major</u> portion of the QC workload.

•• After-the-fact QC. This involves random technical and procedural checking of products after they have been used. It includes checking the accuracy of transmission, timeliness, product compatibility, plotting errors, careless analyses, etc.

Items 1 through 5 of the QC Checklist (Figure 6.1) will help you determine whether your QC program is accomplishing its purpose.

• Monthly Evaluation Summary. You must now pull together a meaningful summary of the monthly verification results and QC findings. This is the consolidated management tool you need to assess your unit's technical quality. Item 6 of the QC Checklist (Figure 6.1) contains an excellent list of what an evaluation summary should contain. Appendix 3 is a Sample Unit Evaluation Summary compiled by 5th Weather Wing from the best of numerous summaries assessed during TCVs conducted over a two-year period. It contains the ingredients typically required if the summary is to become the management tool it is intended to be.

SELF-INSPECTION

(Ref: AWSR 123-1, AWSP 123-2, AWSP 123-5)

One of the most valuable management tools available to help you assess the technical quality of your forecast support is the self-inspection. If performed properly, it provides a detailed internal review and evaluation of the various important technical aspects of the forecasting function and shows whether your unit is accomplishing the mission it is tasked to perform. AWSR 123-1, "Self Inspection Program," requires that you, the detco, conduct a self-inspection within 90 days of your arrival on station. Two excellent and comprehensive self-inspection guides which apply to the technical aspects of the forecasting function are AWSP 123-5, "AWS Aerospace Sciences Guide," and AWSP 123-2, "AWS Operations Guide."

Following are a few rules that will keep you in good technical health:

• Never "pencil whip" self-inspection checklists.

• Document the deficiencies found and realistically suspense actions to correct deficiencies.

FIGURE 6.1. QC CHECKLIST.

PAGE 1 OF 1 PAGES

TITLE/SUBJECT/ACTIVITY/FUNCTIONAL AREA	OPR	DATE
QC Checklist (ref AWSR 178-1)	5 WW/DNS	JULY 1980

NO.	ITEM (Assign a paragraph number to each item. Draw a horizontal line between each major paragraph.)	YES	NO	N/A
1.	Is on-the-spot QC effective? Are most errors identified and corrected on-the-spot before products reach the customers? Include examining the technical goodness of products? (para 4-2a)			
2.	Does the QC DOI/SOP specify products to be evaluated (para 1-3d(1))? Do these include all products provided to AWS and/or operational customers? (para 4-2c)			
3.	Does QC directive specify local standards and minimum sample sizes for each product checked during after-the-fact QC? (para 4-2d)			
4.	Are sample sizes and standards realistic? Understood? Attainable? Are sample sizes and standards adjusted based on performance? (para 4-2d)			
5.	Are QC monitors assigned for each product that is checked during after-the-fact QC? (5 WW suggested approach) a. Do monitors detect most errors and promptly note them on AWS Form 80? (para 4-2b) b. Do monitors insure that individuals acknowledge their errors and take corrective action? (para 4-2b)			
6.	Do evaluation summary letters contain: (Atch 3 and 5 WW Sup 1) a. Quality control: (1) A realistic description of the units performance? (2) A summary of significant problems noted during on-the-spot QC? (3) A list of products/areas monitored during after-the-fact QC/ (a) Time or period of sample for each product? (b) Number of errors by type? (4) An analysis of the cause of errors and corrective action taken or planned to correct the errors? (5) Results of previous corrective actions? (6) Status of open items? b. Technical verification: (1) Analysis of the past month's TAFVER and weather warning performance with emphasis on trends, problem areas, and corrective actions. (2) Analysis of the unit's OPVER performance. (3) Analysis of the representativeness of INTER groups. (4) Analysis of the timeliness and effectiveness of TAF amendments. c. Is the unit addressing the "technical goodness" of its products in addition to the "procedural goodness?"			

· Inform the functional OPR about the discrepancy and give him/her the opportunity to come up with a solution.

· Insure key factors bearing on the problem have been considered before determining the best solution.

· Assure that effective follow-up action has been taken before closing out the finding.

Appendix 4 provides valuable words of wisdom--direct from the Air Force Inspector General's office--which you should integrate into your self-inspection program.

TECHNICAL CONSULTANT VISITS (TCVs)

(Ref: AWSR 11-1, AWSP 105-44)

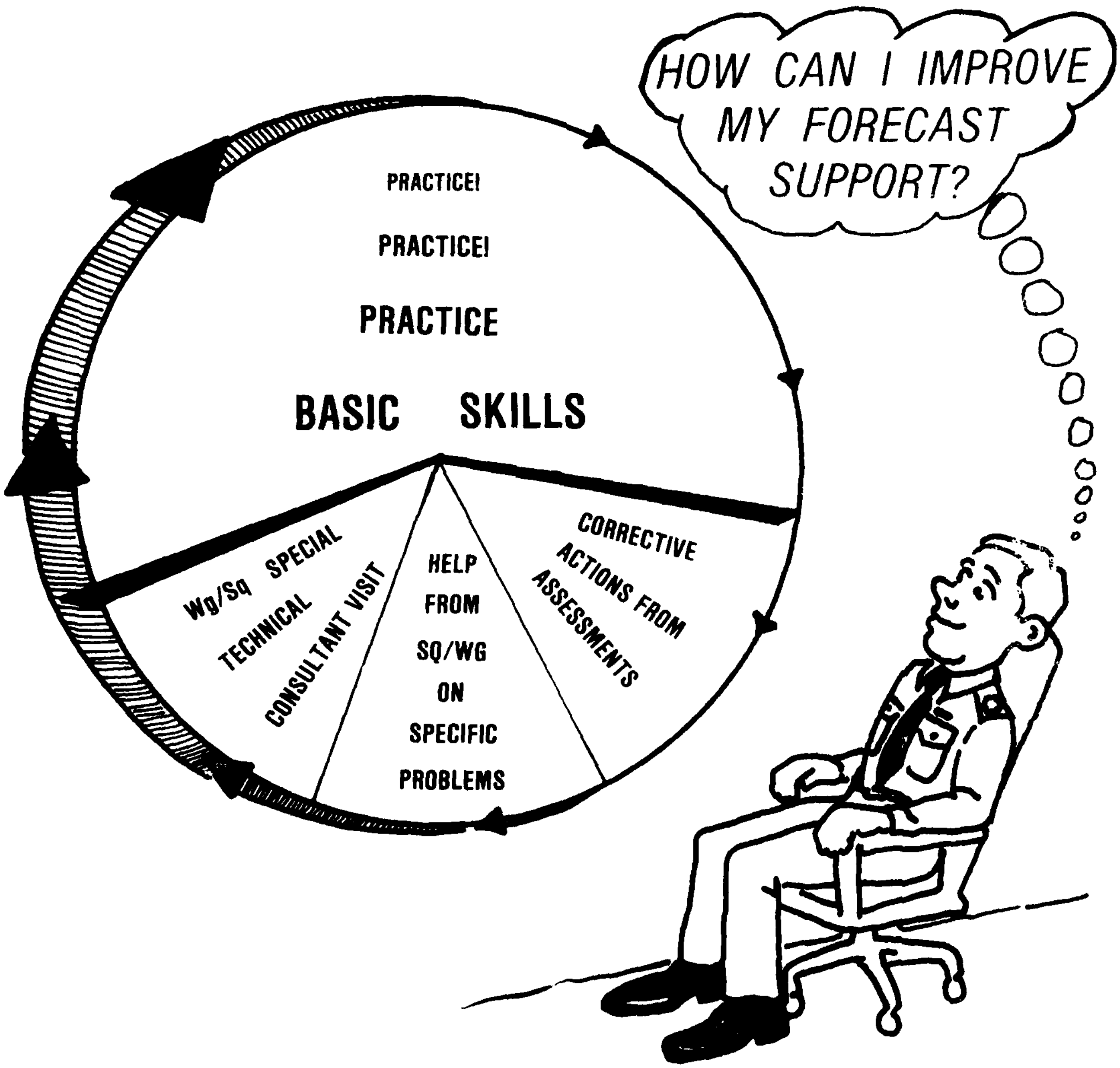
The primary objective of a TCV from your squadron or wing should be to improve the technical effectiveness of your unit's forecasting function--NOT TO PLAY IG. If the technical consultant properly conducts and effectively documents the results of the visit (and this is the rule rather than the exception), the TCV report will prove to be quite valuable to you. It will include your unit's technical strengths/weaknesses and suggested corrective actions. (Hopefully, the consultant will already have helped your people complete the bulk of the actions required before the visit ends.) In any case, you should carefully review the TCV report to determine what problems existed at the time of the TCV and whether corrective actions have been taken.

OTHER VISITS/INSPECTIONS

You may find other clues to the strength of your forecast support by carefully reviewing your unit's last IG inspection and assistance visit (AV) reports. Again you should know what these reports cited about the technical health of your unit and insure corrective actions have been taken to keep your forecasting function "solid."

NOTES

CHAPTER 7



HOW CAN I IMPROVE MY FORECAST SUPPORT?
PRACTICE!
PRACTICE!
PRACTICE
BASIC SKILLS
Wg/Sq SPECIAL TECHNICAL CONSULTANT VISIT
HELP FROM SQ/WG ON SPECIFIC PROBLEMS
CORRECTIVE ACTIONS FROM ASSESSMENTS

CHAPTER 7

HOW CAN I IMPROVE MY FORECAST SUPPORT?

PRACTICE! PRACTICE! PRACTICE BASIC SKILLS!

How do "star" athletes--baseball players, gymnasts, golfers, whatever--become the best. The answer is fundamental: PRACTICE! Likewise, how do your forecasters become star performers? Again--through continual practice. This doesn't mean just reading about how to forecast, although this has its place. No, it means doing it--rolling up sleeves and putting the "analysis pencil" on the weather charts. The forecaster who has carefully analyzed the charts gains a true 4-dimensional (space and time) appreciation of what's causing today's weather and how it will change. Ultimately, he becomes a "star." And if you espouse this procedure, your whole team can excel technically. As pointed out in Chapter 2, this is even more critically important in today's "world" of abbreviated formal training and quantum decreases in forecaster experience. But there must be some "method to the madness," some systematic analysis and forecasting procedures to follow. It must be basic--something your highly intelligent but inexperienced forecasters can "wrap their arms around" and cultivate through daily practice. The analysis procedures previously laid out in Chapter 4 have been tested and proven; they will work at your unit (with some adjustments if you're not in the mid-latitudes). But where do you fit into the "forecasting equation"? Read on.

CORRECTIVE ACTIONS FROM ASSESSMENTS

In the previous chapter, several tools to assess the quality of your forecast support were mentioned: Product evaluation, quality control, self-inspections, and reports on TCVs and other visits. Each of these is geared to point out not only your forecasting team's strengths but also potential technical deficiencies or areas where fine-tuning may be needed. However,

discovering the problem is only part of the equation. Solving it is the next step. This entails the traditional problem-solving process:

- Explicitly define the problem.
- Collect the facts pertinent to the problem.
- Study and evaluate the facts.
- Arrive at a conclusion.
- Decide on and implement the best course of action.

Once you've done this, the "loop" is closed.

HELP FROM THE TECHNICAL EXPERTS

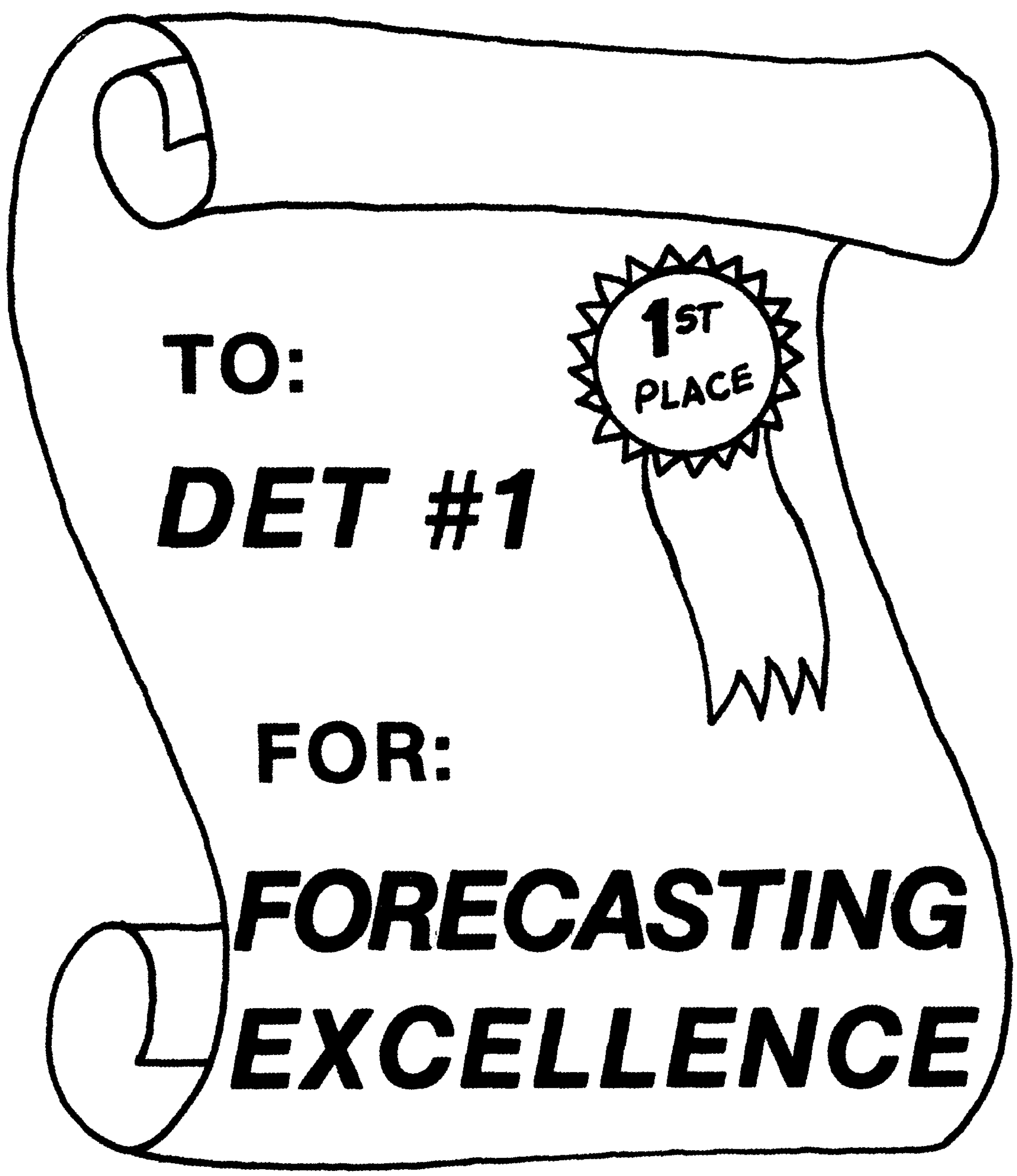
"Technical experts? Where? How can I get them to assist?" you might ask. Yes, they do exist and are at your disposal. If the personnel system is working, they reside at your squadron DON shop, your wing DN shop, and AWS/DN. When specific technical problems arise for which you need assistance, there are two avenues to take:

- "Informal" Route. Your initial point of contact is usually your squadron DON (generally a one-deep position filled by a technical consultant with an advanced degree in meteorology. He should either be able to provide direct assistance or "know the ropes" on who at higher headquarters can help. Get to know him--he's vital to your "technical health."

- "Formal" Route. Occasionally technical problems cannot be solved via telephone or written correspondence alone. That may be the ideal time to get the "expert" to come to you. You might wonder, "Isn't that unusual? Doesn't that make me look like I don't have my 'kit' together?" Not if you've done your homework and still deem the assistance necessary. In fact, that's what special TCVs and technical consultants are all about. Most likely, you will either be visited by your squadron "DONer" or a knowledgeable wing technical

consultant. In either case, his job is to help you improve the technical effectiveness of your unit's forecasting function. The success rate has been high--so if you need "on the spot" help, it is available. You and your customers will be glad you did.

CHAPTER 8



CONCLUSION: COMMAND EMPHASIS—THE KEY TO FORECASTING EXCELLENCE!

CHAPTER 8

CONCLUSION: COMMAND EMPHASIS—THE KEY TO TECHNICAL EXCELLENCE!

Without question, the station chief is vital to the forecasting operation. However, contrary to the opinion of some, he is not the primary catalyst for motivating your forecasting team. YOU ARE! Without your personal emphasis on and genuine support of the forecasting function, the station chief's task becomes difficult at best--and sometimes impossible. You must demonstrate your intense desire for forecasting excellence from your team. You can achieve this through a combination of several active efforts:

• Routinely participate in daily forecast discussions. Listen to what the discussion leader has to say and ask questions that will help him/her think and develop as a forecaster. Stimulate fruitful discussions.

• Spend "constructive" time each day in the forecasters' work area talking about the weather analysis/forecast and tactfully providing your expert opinion. Offer meaningful feedback to your forecasters and don't be afraid to compliment them for a job well done. Remember, a well-deserved "pat on the back" goes a long way.

• Periodically, show up on a night shift or weekend to gain an appreciation of how the "other half" lives.

• Demonstrate your willingness and ability to pitch in during "surge" periods and occasionally work a shift, including a night shift.

• When the weather threatens the customer's operation--BE THERE! Be visible, be concerned, be supportive of your forecasters, be aware of the operational impacts, and be professional!

The bottom line is, "Don't spend all your time behind the desk." Your forecasters also need you. I know what you're thinking: "There's only 24 hours in a day. I can't possibly afford the time required to get that involved." But consider a more pertinent question: "Can you afford not to take the time?" You must not yield to the common temptation of devoting all your time "pushing paperwork." An appropriate truism is, "You manage things, but you lead people." To be a good commander, you must be more than a good manager--you must be the LEADER of your detachment.

REFERENCES

AWS Follow-on Training Seminar #STT-Q9-004. Back to Basics. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), May 1979.

AWS Pamphlet 105-51. Probability Forecasting: A Guide for Forecasters and Staff Weather Officers. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 31 October 1978.

AWS Pamphlet 105-56. Meteorological Techniques. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 1 August 1979.

AWS Pamphlet 123-2. AWS Operations Inspection Guide. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 5 March 1980.

AWS Pamphlet 123-5. AWS Aerospace Sciences Inspection Guide. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 21 May 1980.

AWS Pamphlet 105-44. Aerospace Sciences Technical Consultant Guide. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 25 January 1978.

AWSR 11-1. AWS Visit Program. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 22 May 1978.

AWS Regulation 50-5. Follow-on Training Program. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 1 August 1979.

AWS Regulation 55-2. AWS Tactical Weather Support. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 31 August 1977.

AWS Regulation 105-8. Meteorological Watch Program. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 15 August 1978.

AWS Regulation 105-13. Probability Forecasts and Weather Impact Indicators. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 17 July 1978.

AWS Regulation 105-20. Meteorological Satellite Direct Readout Operations. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 17 March 1978.

AWS Regulation 105-22. The Local Analysis and Forecast Program. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 14 April 1978.

AWS Regulation 105-29. Quality in Forecast Products. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 25 February 1980.

AWS Regulation 123-1. Self-Inspection Program. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 26 November 1979.

CONTINUED

AWS Regulation 178-1. Product Evaluation. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), 5 March 1980.

AWS Technical Note 79/002. Forecast Reviews and Case Studies. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), May 1979.

AWS Technical Report 218. Preparation of Forecast Worksheets. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), October 1969.

AWS Technical Report 76-264. Satellite Meteorology. Scott AFB, Illinois: Headquarters Air Weather Service (MAC), August 1976.

Federal Meteorological Handbook 7, Part C. Weather Radar Observations. Scott AFB, Illinois: Headquarters Air Weather Service, 26 August 1977.

Fifth Weather Wing Forecaster Memorandum 80/001. Checklist of Analysis Options for Use With Centrally Prepared Facsimile Products. Langley AFB, Virginia: Headquarters Fifth Weather Wing (AWS), April 1980.

Fifth Weather Wing Pamphlet 105-8. Considerations in Developing and Managing a Local Analysis and Forecast Program. Langley AFB, Virginia: Headquarters Fifth Weather Wing, 6 August 1979.

Fifth Weather Wing Regulation 80-1. Terminal Forecast Reference Notebook and Technical Studies. Langley AFB, Virginia: Headquarters Fifth Weather Wing (AWS), September 1980.

Fifth Weather Wing Technical Note 78-1. The Use of Wind Stratified Conditional Climatology Tables. Langley AFB, Virginia: Headquarters Fifth Weather Wing (AWS), February 1978.

Report on the Technical Readiness of 5th Weather Wing. Headquarters Fifth Weather Wing. Langley AFB, Virginia: 15 January 1980.

Seventh Weather Wing Technical Note 80/001. Forecast Worksheet: A New Approach. Scott AFB, Illinois: Seventh Weather Wing (AWS), 1 May 1980.

5 WW/FM-80/001

5TH WEATHER WING FORECASTER MEMO

CHECKLIST OF ANALYSIS OPTIONS

FOR USE WITH

CENTRALLY PREPARED FACSIMILE PRODUCTS

APRIL 1980

5 WW/DNS

This checklist of analysis options was compiled primarily from 5 WW Seminar 78-1, "Back-to-Basics." The items marked with asterisks (*) are the fields which should be analyzed routinely when time allows. Other fields should be analyzed as dictated by available time and the synoptic situation. By following this systematic analysis routine and discussing your interpretation of these analyses and prognoses during forecaster discussions, you will be able to strengthen your understanding of how the atmosphere works. This knowledge will not only improve your ability to forecast at home station but will also prepare you to forecast at any mid-latitude station. For this reason we encourage all units to analyze upper air and surface data for a large portion of the US. Even though the analyses may not always contribute directly to the preparation of the local terminal forecast, this effort will vastly increase your unit's technical readiness to support its wartime mission.

Principal Authors: Major Frank T. Carvell and Captain Stephen M. Horn

APPENDIX 1: 5WW FM-80/001

UPPER TROPOSPHERIC ANALYSIS (300mb, 250mb, or 200mb):

*1. Highlight the location of the maximum wind band(s) (RED ARROW). Be careful to distinguish between the polar and subtropical jets.

*2. Maintain continuity on the location of the maximum wind band (YELLOW).

*3. Use the location of the maximum wind to determine:

a. Primary storm tracks.

b. Proper location of the triple point along occluded frontal systems.

c. Areas of upper level diffluence.

500-MB ANALYSIS:

*1. Maintain 24-hour continuity of troughs, lows, ridges, highs, and significant height fall centers (YELLOW).

*2. Sketch major trough and ridge features (PENCIL).

3. Trace a representative seasonal contour (BLACK). This shows the amplitude changes of the height field. Maintain 24-hour continuity on this contour (YELLOW).

*4. Examine the 12-hour height change field. Mark significant (e.g. $\geq$ 50 meters) height fall and rise centers (PURPLE)and follow continuity on the height fall centers (YELLOW). Also use the height change fields to refine trough and ridge positions.

5. Check the isotherm analysis and highlight as required (RED). Use the isotherm pattern to help you refine your trough/ridge placement.

6. Clearly mark regions of strong cold (BLUE) and warm (RED) air advection.

7. Analyze areas of mid-level moisture using the 5° (or 3°) dewpoint depressions (GREEN).

*8. Finalize analysis of trough and ridge features (BLACK).

700-MB ANALYSIS:

*1. Maintain 24-hour continuity of troughs, ridges, highs, and lows (YELLOW).

*2. Analyze trough and ridge features (BLACK). Check stack with 500-mb and 850-mb features before finalizing the analysis.

3. Check isotherm analysis and highlight as required (RED).

4. Mark regions of cold (BLUE) and warm (RED) air advection.

5. Analyze areas of mid-level moisture using the 5° (or 3°) dewpoint depressions (GREEN).

850-MB ANALYSIS:

*1. Mark 24-hour temperature changes in the vicinity of suspected frontal zones (PENCIL).

*2. Maintain 24-hour continuity of highs, lows, fronts, and when appropriate, troughs & ridges (YELLOW).

*3. Highlight key isotherms, being careful to check the accuracy of the machine analyses (RED).

*4. Sketch your "first guess" of polar and arctic frontal locations (PENCIL).

*5. Mark areas of strong cold (thin BLUE arrow) and warm (thin RED arrow) air advection.

6. Highlight low level wind maxima (heavy RED arrow).

7. Analyze the 3^o dewpoint depression lines (GREEN) (or another value, if appropriate for your location. The 3^o line gives a good indication of low clouds in the eastern U.S.).

8. Find areas of moisture advection and determine if the advection will change.

*9. Finalize analyses of polar and arctic fronts (BLACK). Insure that the upper tropospheric wind maximum supports your analysis and that you have reasonable stack with 700-mb and 500-mb troughs.

SURFACE ANALYSIS:

1. Depict the sensible weather (APPROPRIATE COLOR).

2. With the 850-mb analyses and your LAWCs as guides, check the NMC frontal analysis and correct it as necessary.

LFM PROGNOSIS:

1. 500-mb Height/Vorticity panels.

a. Highlight a representative seasonal contour (BLACK) on each of the 500-mb panels. This contour should be the same contour highlighted on the 500-mb analysis.

*b. Compare the LFM initial analysis panel to your 500-mb analysis--insure the initial analysis is correct. Satellite data, if available, should also be used to check the LFM initial analysis.

*c. Compare the LFM 12-hour 500-mb prog with your prog (based on pure extrapolation of 500-mb features). If there are significant differences, determine whether the LFM is correct or whether there were model initialization problems which invalidate the LFM progs.

d. Indicate areas of significant PVA (RED) and NVA (BLUE).

2. 700-mb Height/RH panels. Outline areas of RH $\geq$ 70% and shade areas of RH $\geq$ 90% (GREEN).

*3. MSL Pressure/1000-500-mb thickness panels. Analyze frontal positions using the 1000-500-mb thickness fields.

APPENDIX 2:

SAMPLE TAF WORKSHEET

DATE: 15 MAR 79 | FORECAST WORKSHEET/VERIFICATION LOG | FCSTR: LR

I. Current synoptic situation: Mark items which will affect station KXYZ within 24 hrs.

SFC: FRONT	TROF		OTHER: HIGH	PSN: 150 NW	MVMT: 250/10	
850 mb: FRONT	TROF		OTHER: RIDGE	PSN: 200 NW	MVMT: 250/10	
700 mb: TROF	RIDGE	✓	PSN: 250NW	MVMT: 250/10	STRENGTHENING/WEAKENING/NO CHANGE	
500 mb: TROF	RIDGE	✓	PSN: 350NW	MVMT: 250/10	STRENGTHENING/WEAKENING/NO CHANGE	

ADVECTION:										
	SFC-850:	WARM	COLD	✓	MOIST	DRY	✓	OVERRUNNING	YES/NO	
	850-500:	WARM	COLD	✓	MOIST	DRY	✓	OVERRUNNING	YES/NO	

2000' WINDS: HAT 03030 WAL 01036 GSO 03025 IAD 36032

500 mb VORTICITY: LFM BAROTROPIC/BAROCLINIC | PVA/NVA/NEUTRAL | STRONG/WEAK

STABILITY: STN WAL INDEX SSI +15 24-HR TREND: +/-

II. Changes in synoptic situation: LITTLE CHANGE.

HIGH DRIFTING SLOWLY EASTWARD

FROPA N/A Z WAVE DEVELOPMENT N/A

EXAMPLE

III. Significant forecast problems: (Aids in parenthesis)

A. CIG/VSBY: (SXUS, Satellite, Skew-T, Studies, ROT, MOS)

FOG: VSBY ____ ONSET ____ Z BREAKUP ____ Z

STRATUS: ONSET ____ Z BASE/TOP ____ BREAKUP ____ Z

OTHER: TYPE SC BASE/TOP 025/050 ONSET/BREAKUP 1600 Z

B. PRECIP: (RADAR, SXUS, MOS, LFM, Studies, ROT)

YES/NO BEGIN ____ Z END ____ Z AMOUNT ____

C. SURFACE WINDS: (Skew-T, MWA, Tech Rpt 200, ROT)

CONVECTIVE GUST ____ KTS NON-CONV GUST 36 KTS (ROT #1)

D. TURBULENCE: TYPE LGT-MDT LEVELS SFC - 030

ICING: TYPE ____ LEVELS ____

IV. YAXX XX guidance: Circle best category in red. If you disagree, state why.

V. AFGWC guidance forecast: Agree/Disagree. If you disagree, state why.

1

5 WW FORM 5 FEB 79 PREVIOUS EDITIONS ARE OBSOLETE

FORECAST: VLD 15/1200 Z to 16/1200 Z MO: MAR YR: 1979

KXYZ 1212 34015 9999 5SC025 QNH3015INS CIG025
GRADU 1416 01020/28 9999 2SC025 520003 QNH3020INS
INTER 1619 03022/36 530003
GRADU 2123 04010 9999 SKC QNH3025INS

AMD# 1 BEFORE AFTER INTER HRS REP 3 HRS NON-REP 0

KXYZ 1512 03022/30 9999 2SC025 520003 QNH3020INS
INTER 1519 03022/36 530003
GRADU 2223 04010 9999 SKC QNH3025INS

EXAMPLE

PER C/D	H+0 12Z	H+1 13Z	H+2 14Z	H+3 15Z	H+4 16Z	H+5 17Z	H+6 18Z	H+12 00Z	H+24 12Z	VERIFICATION	3	6	12	24
CC	C/D	C/D	C/D	C/D	C/D	D/D	D/D	D/D	D/D	FCST VS CC	0	0	0	0
FCST	CIG/VIS	C/D	C/D	C/D	D/D	D/D	D/D	D/D	D/D	FCST VS PER	0	+1	+1	+1
OBS	CIG/VIS	C/D	C/D	D/D	D/D	D/D	D/D	D/D	D/D	PER VS OBS	-1	-1	-1	-1
≤1000/2	FCST/OBS													
WND >34KTS	FCST/OBS			/+	+/+	+/+	+/+							

MISSED OPPORTUNITY

WRNG REQ YES 1500 Z NO MWA REQ YES 1400 Z NO LLWS ADV YES 1500 Z NO FCST REVIEW YES NO

2

--SAMPLE--

UNIT EVALUATION SUMMARY FOR SEPTEMBER 1980

1. Unit Quality Control (QC) Summary -- Forecasting and Observing.

a. Results of on-the-spot QC.

(1) Assess the general results of procedural and technical on-the-spot QC (e.g., assessment of the mechanics of the analysis, as well as its technical quality).

(2) Identify problem areas, adverse trends, and/or areas of good performance.

(3) Discuss corrective action taken or planned.

(4) Assess the effectiveness of previous corrective action, as appropriate.

b. Results of after-the-fact QC.

(1) Compare results for each product/area monitored (both procedural and "technical goodness" aspects).

(2) Identify problem areas, adverse trends, and/or areas of good performance.

(3) Discuss corrective action taken or planned.

(4) Assess the effectiveness of previous corrective action, as appropriate.

(5) List the products monitored, time period covered, and performance as an attachment to the summary.

2. Forecasters' Technical Verification

a. TAF Performance

TAF	Number Issued	Station Correct	Persistence Correct	Skill Score	Goal	Percent of Goal
3-HR						
6-HR						
12-HR						
24-HR						

b. Weather Warnings

(1) Number issued/required/met DLT/some positive lead time/required but not issued.

(2) Time in effect

(a) Before terminating after last occurrence.

(b) Before cancelling if a false alarm.

c. TAF amendments (Number required, number issued before-the-fact, number requiring amendment but none issued).

d. TAF INTER groups (use rate, verification rate, and representativeness).

e. OPVER performance, as appropriate.

f. Verification of other forecast products (i.e., probability forecasts, met watch advisories, mission control forecasts, range forecasts, etc.).

(Address problem areas, corrective actions, and follow up on previously identified areas for each of the above paragraphs.)

APPENDIX 3: SAMPLE UNIT EVALUATION SUMMARY

--SAMPLE ATTACHMENT TO MONTHLY UNIT EVALUATION SUMMARY--

FORECASTER PRODUCTS MONITORED

1. Finished Products (what the customer gets).

Product	Sample Period/Number	Errors	Error Rate Last Month/This Month	Goal
TAFS	TT/50	5	10%/5%	2%
175-1	MWF/200	5	2.5%/4.0%	3%
LPW	All/6	1	16%/0%	3%
PMSV				
MWA				
(Others)				

2. Component Products

a. Procedural Inputs

Product	Sample Period/Number	Procedural Errors	Error Rate Last Month/This Month	Goal
Fcst Wksht				
LAWC				
Skew-T				
RAREPS				
PIREPS				
(Other)				

b. Technical Inputs

Product	Sample Period/Number	Technical Errors	Error Rate Last Month/This Month	Goal
Fcst Wksht				
LAWC				
Skew-T				
RAREPS				
PIREPS				
(Other)				

NOTE: This section on the technical inputs may be accomplished in narrative style. However, do not allow a narrative analysis to become a few meaningless words and phrases that fail to properly relate your unit's technical goodness. Make it meaningful.

APPENDIX 4: SELF INSPECTION

INSPECTION

IS THE MISSION BEING ACCOMPLISHED?

SELF-INSPECTION: MISSION EFFECTIVENESS AND READINESS—USAFSS

Results of recent command inspections have verified what we in the inspection business have long suspected: Those units with strong self-inspection programs do the best in Management Effectiveness Inspections (MEIs) and Operational Readiness Inspections (ORIs). The units with successful self-inspection programs had several factors in common: (a) active commander involvement, (b) management support of the program, and (c) highly qualified people to conduct the self-inspections.

Developing and managing an effective self-inspection program requires a team effort and an active and positive role on the part of all players—that's what we found in those units which had achieved a rating of satisfactory or better.

Take a look at your own program. Can you answer "yes" to the following questions?

✔ Is the commander actively involved, particularly in the initial planning phases? Does the commander ensure that individuals selected for the team are fully qualified in their Air Force specialties? Does the commander brief the "team chief" on the conduct and objectives of the self-inspection? Does the team chief report directly to the commander?

✔ Do responsible managers ensure that the program is emphasized at all levels and on a continuing basis?

✔ Is a fully qualified individual selected as the inspection report monitor?

✔ Is the report monitor the focal point for monitoring responses to findings and ensuring that actions taken are both appropriate and adequate to correct deficiencies?

✔ Do unit managers fully support the intent of the program and play an active role in responding to and fixing deficiencies?

✔ Are self-inspections scheduled so they do not conflict with the assigned mission? Is the time allotted adequate for a thorough self-inspection?

(As a general guideline, the inspection should not be conducted during periods of abnormal activity or during a holiday period. Furthermore, a period of several weeks is not considered excessive for a comprehensive self-inspection.)

✔ Are command or self-inspection checklists used only as guides and not as all encompassing checklists for conducting the inspection?

✔ Are inspections "management oriented" with less emphasis on pure "yes/no" compliance responses?

✔ Do unit managers review and react to other units' inspection reports as well as their own previous reports? Do they take actions based on staff assistance visits and information contained in trend analysis reports and TIG BRIEF? Does the report monitor ensure wide dissemination of this information to all unit managers on a consistent and timely basis?

✔ Are results of an inspection briefed to the commander and staff? Are copies of the report disseminated to inspected elements on a timely basis?

A key to a good, solid operation is an objective, thorough, and critical self inspection program. An effective program will identify and isolate problem areas and afford the unit an opportunity to take necessary corrective action. The benefits gained in mission effectiveness and improved readiness will more than justify the time and energy expended implementing the program. (SMSgt Heffernan, IGIR, AUTOVON 945-2891) ■

(TIG Brief 16, 19[illegible])

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